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VITRIFIED CLAY PIPE

Handles Tough Assignment

For New G. M. Plant's Sanitary Sewer System

VITRIFIED CLAY PIPE was used exclusively for the sanitary sewer system of General Motor's new $7,500,000 assembly and distributing plant 1½ miles north of Van Nuys, California. Clay Pipe was specified because it is the *only* pipe impervious to the corrosive action and acidity of the industrial wastes to be drained off through the sewer system.

In some places the sewer trenches ranged from 12 feet to 22 feet in depth to get the required fall. The soil is very sandy and subject to seismic conditions. The sewer system runs under railway tracks and roadways where it is subject to extra heavy loads. In these installations, Extra-Strength Clay Pipe was used.

On *any* industrial sewer line installation, it pays to specify Clay Pipe. If you need specific information on Clay Pipe, write the office nearest you.

Eight thousand feet of Vitrified Clay Pipe was used in constructing the new General Motors sanitary sewer system and connecting it with the Los Angeles sewer system. Where extra-heavy loads were encountered, Extra-Strength Clay Pipe was specified. Donald Parkinson of Los Angeles was the architect. The E-L-E Company of Los Angeles were consulting engineers. E. Willardson, Plumbing and Heating Contractor, also of Los Angeles, installed the Clay Pipe. Superintendent on the job was Walter A. Moss.

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Vitrified
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Panama Canal Symposium to Keynote ASCE Annual Meeting in New York

THE ANNUAL MEETING COMMITTEE welcomes you to New York for the 95th Annual Meeting of the Society. The Hotel Commodore has again been selected as headquarters and the Committee is assured that accommodations for members and their guests will exceed even the high standards of previous years. Of particular interest to those who live outside of New York is the substantial increase in the number of hotel rooms which will be reserved for members. This year we have been able to secure the Century Room at the Commodore for the Ladies Entertainment on Thursday, so that for the first time, all events except excursions will be held at one location. Moreover, the hotel has made available for the use and convenience of the ladies throughout the entire meeting a pleasant and nicely appointed suite of rooms known as the Club Suite. The ladies are invited to make these rooms their headquarters for meeting their friends and for bridge, reading, knitting or just relaxing. Members of the Ladies Committee will be present each day to assist in any way possible.

1948 Annual Meeting Committee
N. M. Quade, Chairman

AS PRINTED in the December issue of CIVIL ENGINEERING, the program of the Ninety-Fifth Annual Meeting contains a number of innovations. One of the outstanding features of the meeting will be the Panama Canal symposium, based on studies made by the Special Engineering Division, which resulted in a recent report by the Governor of the Canal Zone recommending construction of a sea-level canal. Opening the symposium with a general session on Wednesday afternoon, January 21, Col. James H. Stratton, M. ASCE, Supervising Engineer of the Special Engineering Division of the Panama Canal will present an over-all statement of the problem of an improved Panama Canal. The general session will be followed by sessions of the Construction, Hydraulics, Soil Mechanics and Foundations, and Waterways Divisions on Thursday and Friday, January 22 and 23, all devoted to the Panama Canal studies in their particular fields.

In addition to the above-mentioned Division sessions, there will be meetings of the Sanitary Engineering Division, Structural Division, Power Division, Highway Division and City Planning Division, and a joint session of the Air Transport Division and the Soil Mechanics and Foundations Division.

Luncheons

The Wednesday and Thursday luncheons are expected to be of particular interest to many members. At the Wednesday luncheon, the speaker will be William L. Batt, president of SKF Industries whose subject will be "How Engineering Can Aid the European Recovery Plan." The Thursday luncheon, arranged under the auspices of the Construction Division, will feature a number of speakers who will give brief addresses on the outlook in various fields of construction, including D. W. Winkelman, President-elect, Associated General Contractors of America; Carlton S. Proctor, Vice-President, ASCE, Consulting Engineer, New York City; Bernard J. Gilroy, Commissioner of Housing and Buildings, City of New York; Rear Admiral J. J. Manning, M. ASCE, Chief of the Bureau of Yards and Docks; J. P. H. Perry, M. ASCE, Vice-President, Turner Construction Co.; and Prof. Elmer K. Timby, M. ASCE, Member, Executive Committee, Construction Division, ASCE.

The meeting will close on Saturday, January 24, 1948, with a sightseeing boat excursion about New York Harbor and lower Hudson River.

William L. Batt

D. W. Winkelman

J. J. Manning

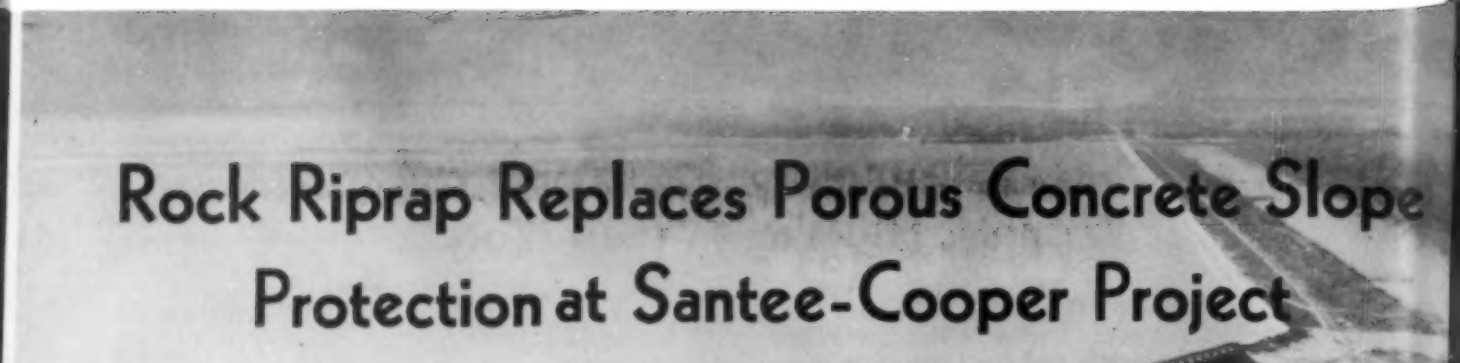
J. P. H. Perry

SPEAKERS AT ASCE ANNUAL MEETING include William L. Batt, who will address Wednesday luncheon, and D. W. Winkelman, Rear Admiral J. J. Manning, and J. P. H. Perry, scheduled to speak at Thursday luncheon meeting. President of SKF Industries, Inc., for past 25 years, Mr. Batt was in Washington during war as vice-chairman of War Production Board. He is authority on postwar European problems, having been abroad on several official missions. Past-president and honorary member of ASME, he recently presided at 8th International Management Congress in Stockholm. Mr. Winkelman, president of D. W. Winkelman Co., Inc., Syracuse, N. Y., contracting firm, will be installed as president of Associated General Contractors of America at organization's annual convention. Long prominent in AGC activities, he is now completing term as vice-president. Member of Navy Civil Engineer Corps since 1918, Admiral Manning, M. ASCE, has served as director of Atlantic and Eastern Pacific Divisions of Bureau of Yards and Docks, and is now chief of Bureau. J. P. H. Perry, M. ASCE, vice-president of Turner Construction Co., New York, is authority in field of reinforced concrete building construction. ASCE Director from 1933 to 1935, he has been chairman of Society's Construction Division and president of Metropolitan Section.

Rock Riprap Replaces Porous Concrete Slope Protection at Santee-Cooper Project

HENRY H. JEWELL, M. ASCE

Construction Engineer, Bureau of Community Facilities
Federal Works Agency, Washington, D. C.



THE FAILURE OF POROUS CONCRETE to provide a durable protection for the upstream surface of the dams and dikes of the Santee-Cooper Project, like the failure of concrete-block protection on the Kingsley Dam (see "Protecting Upstream Slope of Kingsley Dam," by Mr. Jewell, in CIVIL ENGINEERING for November 1945), illustrates the need for adequate advance engineering study and the application of tried and tested materials and methods in the design and construction of slope protection for earth dams subject to wave action. Constructed by the South Carolina Public Service Authority, at a cost of $53,625,000 and financed by loan and grant funds of the Public Works Administration, the Santee-Cooper Hydroelectric and Navigation Project (Fig. 1) was placed in operation in 1942 although some of the construction work—principally slope protection, transmission lines and substations—has not yet been completed owing to delays caused by the war and continuing shortages of materials and labor.

CORRECTIVE SLOPE PROTECTION measures are under way along 11 of the 50 miles of rolled-earth and hydraulic-fill dams and dikes that create lakes with storage capacity of 2,460,000 acre-ft in Santee-Cooper Project between Columbia and Charleston, S.C. Pictured above is spillway of 8-mile-long North Santee Dam across Santee-Cooper swamp. Power plant at Pinopolis Dam, where 75-ft head is developed, has present installation of 130,000 kw with ultimate capacity of 160,000 kw.

EXCEPT FOR THE SPILLWAY, powerhouse and lock sections, all dams and dikes of the Santee-Cooper Hydroelectric and Navigation Project are of earth—either of the rolled-fill or hydraulic-fill type. The Santee Dam has a maximum height of 48 ft and the Pinopolis Dam rises to a maximum of about 80 ft above the marl subsoil. Figure 2 shows a typical cross section of the Santee Dam where the maximum high-water level is at El. 75.0 and the minimum low water (crest of spillway) is at El. 63.0. Operating levels range from about El. 67 to 76.

Upstream slope protection was placed from the berm at El. 55.0 or higher where the natural ground level

FIG. 1. SANTEE-COOPER PROJECT—multipurpose development of Santee and Cooper Rivers in South Carolina, includes power and navigation facilities for large area. Lakes cover 250 sq miles.

was above that elevation, to the crest at El. 88.0. Therefore, the protected slope has a maximum width of about 103 ft measured along the slope, about 41 ft of which is subject to wave action. Protection against wave action has been provided for a total of 39.2 miles of dams and dikes, of which 15.6 miles are protected by a porous concrete slab 10 in. thick on 4 in. of gravel, and the rest, where exposed to wave action, is covered with riprap.

The maximum water distance or "fetch" for which upstream slopes are protected is about 15 miles. The north Santee Dam is partially protected by a fringe of timber left standing in the reservoir which, however, is gradually falling. To prevent slope damage from this source, floatage is removed soon after it reaches shore.

The decision to use porous concrete as the principal slope protection material was reached after study and consideration of many types of materials including reinforced concrete, concrete blocks and rock riprap. The only rock encountered in excavating for the project structures was unsuitable for riprap subjected to heavy wave action and was limited in quantity. The nearest source of durable riprap rock was the granite quarries near Columbia, S.C., requiring rail transportation at a cost then considered prohibitive. Reinforced concrete apparently was rejected because of the possibility of failure due to hydrostatic head from receding waves. Later, after the failure of porous concrete, a reinforced concrete slab was proposed and alternate bids were taken on rock riprap and reinforced concrete.

Wave Action on Porous Concrete Unknown

When porous concrete was selected for slope protection it had been used on the project as a drainage layer under the apron of the Santee spillway. Although it had been extensively used elsewhere for similar drainage purposes, its use as slope protection on an earth dam subject to wave action was a radical departure from known experience.

AFTER TWO YEARS of wave action, inspection of porous concrete slab on slopes of North Santee Dam, below full-reservoir level (El. 75.0), revealed partial or complete erosion to depth of about 2 in. Porous mat reaches from berm at El. 55.0 to crest of dam at El. 88.0. Water surface in photograph is at El. 72.86.

Samples of porous concrete, of several different mix proportions of cement and gravel (1/4 to 3/4 in.) varying from 1:7 to 1:10, with no sand, were then made and subjected to alternate freezing and thawing tests. The 1:8 specimens showed a loss of about 2 percent in 50 cycles. This latter proportion, requiring 1 bbl of cement per cu yd with aggregate as follows, was adopted for construction:

Not more than	5% retained on 3/4-in. sq screen
	40% to 60% retained on 3/8-in. sq screen
	82% to 90% retained on No. 4 screen
Not less than	95% retained on No. 8 screen

Slab thickness was designed at 10 in., to be placed on a layer of pea gravel 4 in. thick on the shell of the dam.

A model of this design was tested at the U.S. Waterways Experiment Station at Vicksburg in July 1940, where water was rapidly raised and lowered against the porous concrete to simulate wave action, with pressure gages placed in the slab to indicate uplift pressure. The report of this test showed no significant uplift pressure.

Although admittedly experimental, porous concrete was therefore adopted for upstream slope protection of dams and dikes for the following reasons:

1. It was estimated that porous concrete would cost about $2,000,000 less than any other suitable material.
2. It successfully stood 50 cycles of freezing and thawing tests. (Here it should be noted that ice action is not a factor in the project area as temperatures are seldom so low as to cause even a paper-thin ice sheet along lake shores. Therefore, except for the minor effect of a temporary ice cover from spray and sleet on the slope above water, ice conditions may generally be disregarded.)
3. Tests showed ample compressive strength.
4. Laboratory test of a full-scale model showed that no uplift pressure would occur from receding waves.
5. It was assumed that floatage composed of large trees, logs and stumps would be removed before it could damage the concrete during heavy wave action.

Extensive Use Not Justified

In the light of subsequent experience these reasons do not appear to have presented adequate justification for such very extensive use of this experimental material under conditions as vulnerable as those at Santee-Cooper. The customary conservative engineering pattern appears to have been broken when, after laboratory tests only, decision was reached to use an experimental slope-protection material on more than 15 miles of earth dams to be subjected to wave action from a fetch up to 15 miles, frequently accompanied by the pounding of great masses of large and unusually heavy driftwood.

Two contracts for slope protection in the total amount of $3,672,925, of

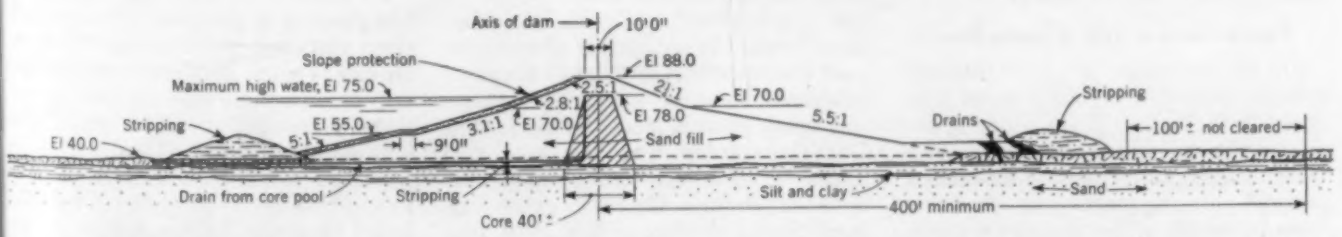


FIG. 2. SECTION THROUGH Santee North Dam shows hydraulic fill with protected slope of about 103 ft (measured along slope), 41 ft of which is subject to wave action. Of total 39.2 miles of dams and dikes, 15.6 miles are protected by 10-in.-thick porous concrete slab on 4 in. of gravel.

PNEUMATIC PAVEMENT BREAKER (top photo) mounted on truck chassis is designed to operate on entire slope, including under-water portion (bottom photo), in breaking 400,000 sq yd of 10-in.-thick porous concrete. Broken mat prevents slippage of new 6- to 12-in. rock filter layer and 24- to 42-in. layer of rock riprap.

which $2,532,752 was for porous concrete and $1,140,173 was for rock riprap on dikes, were completed in July 1942. The reservoirs were filled to maximum capacity for the first time in September 1942. The methods of porous-concrete slope-protection construction for the two reservoirs were quite different. On the Pinopolis Reservoir the concrete was poured in alternate strips 20 ft wide from berm to top with a considerable lapse of time between pours in adjacent strips, while on the Santee Reservoir the concrete was poured continuously except for the interval elapsing between successive days' pours and for interruptions due to weather.

Porous Concrete Fails at Santee Dam

In the summer of 1942 several failures occurred in the porous concrete on the Santee Dam from expansion of the slab which resulted in overthrust shear and crushing extending generally in a transverse direction from below the water line to the crest. Very few cracks of this character have appeared on the Pinopolis Dam where the concrete was poured in alternate 20-ft strips. Cracks continued to appear on the Santee Dam so that it was necessary to adopt a systematic method of repair which generally consisted of cutting out the cracks for a width of about 18 to 24 in. and refilling with solid concrete.

In the spring of 1944 when the reservoirs were full, examination of the porous concrete from maximum water level to crest indicated good condition in that area except for the cracks mentioned above and some signs of deterioration in the wave belt above high-water level. Later in that year when reservoir levels were lowered it was evident that disintegration of the surface below water had commenced. Partial or complete erosion to a depth of about 1 to 2 in. was apparent in most of the area subjected to wave action. Damage was more pronounced on the Santee Dam than on the Pinopolis Dam.

Only after a period of examination, tests and engineering study extending from the fall of 1944 to July 1946, was it possible to secure agreement among engineers of the three agencies concerned, the South Carolina Public Service Authority, the Federal Works Agency and the Federal Power Commission, as to the character and extent of the repairs. Consulting engineers were engaged both by the Authority and by the Federal Works Agency to investigate, report on and recommend remedial measures. In the studies and conferences that followed, so much disagreement occurred among the engineers as to the design and extent of the repair work that it was finally necessary for the three agencies to select a board of consulting engineers to examine and report on the slope protection, whose decision would be accepted as final. Nowhere else in the writer's rather long experience in engineering and construction work has he encountered so much divergence of opinion among competent engineers as to the proper remedy for an engineering failure, the solution of which at first view appeared comparatively simple.

Reconstruction Program Necessary

Differences of opinion first developed as to whether or not any extensive repairs were necessary other than continuance of the repair of cracks on the Santee Dam. As the investigations continued it was tentatively agreed that a reconstruction program was necessary for all porous concrete in the wave belt above low-water elevation. Finally it was decided that the new construction should extend from the submerged berm at El. 55 to 3 ft above full reservoir level, that is, to El. 78. The wisdom of the decision for extensive new construction was borne out by the fact that in February 1947 when stormy weather and extensive driftwood floatage occurred, the condition of the porous concrete became so bad that it was necessary to rapidly lower the water to a level about 5 ft below maximum in order to protect the upstream slopes from further damage. It was then necessary to commence extensive emergency repairs by gunite, although by that time work was already under way on rock riprap protection.

In the fall of 1944 the Authority commenced a program of investigations and tests of the porous concrete. Gunite of several different thicknesses and penetrations was applied to sections of the slab several hundred feet long on the Pinopolis Dam, including panels in which 4-in.-wide strips were left untreated to provide for relief of uplift pressure from receding waves. Heating and cooling tests were applied to the gunite. A hydrostatic-head test was also made by pumping

water into a wooden cofferdam on the slope of the gunite-covered porous concrete slab and observing the rise of water in tubes embedded in the slab at various points below the cofferdam. Results of this latter test were considered inconclusive since it did not duplicate all of the conditions accompanying receding wave action. Eventually gunite was rejected because it was believed that even if reinforced with wire it would not have sufficient permanence and strength to prevent extensive cracking similar to that which had already occurred on the Santee Dam.

A field investigation, accompanied by core borings and laboratory tests, was made by the U.S. Corps of Engineers under the direction of B. Mather and Charles E. Wuerpel, in November and December 1944. Tests of the cores of porous concrete showed compressive strengths varying from 790 to 2,915 psi. Visual observation of the slab in the upper wave belt showed a loss of cement coating on surface pebbles to a depth of about 2 in. on the Santee Dam. Subsequent tests confirmed earlier indications that removal of cement paste was due to the chemical action of the water, having substantial capacity for solution of calcium carbonate as the water circulated through the voids of the porous concrete.

Porous Concrete Cores Tested

Additional cores of porous concrete taken from the slab below low-water level in May 1945 and May 1946 showed compressive strengths as follows:

Lb per Sq In.		1946, %
1945	1946	of 1945
905	595	66
1,260	1,250	99
1,665	920	55

Tests of the cores from below El. 75 indicated a considerable reduction in compressive strength. In general, there was a reduction in strength to about half that of new porous concrete. The samples from the slab below high water (El. 75) showed a marked change in the character of the cement hydrate as compared with those from above high water. A photograph shows the porous concrete on the North Santee Dam as of October 29, 1946, above water-surface El. 72.86.

FLOATING PLANT PLACES RIPRAP on slope of North Santee Dam by means of cranes and clamshell buckets. Rock from quarry near Congaree River is transported to site by barges and LCT'S.

Laboratory tests of samples of water from the reservoirs showed a low alkalinity with free carbon dioxide up to 23 ppm, resulting in a calcium carbonate demand up to 40 ppm. On the average, each million gallons of water in the Santee Reservoir, which showed the highest $CaCO_3$ demand, has a demand for about 167 lb of calcium carbonate. This demand is of two parts, one due to the carbonic acid action of the carbon dioxide and the other to the calcium deficiency of the water.

Studies of the problem included investigations, tests and photographs of wave action in the laboratory tanks of the Beach Erosion Board, Washington, D.C. An experimental wooden cofferdam with canvas covering extending 20 ft on each side on the porous concrete and down to El. 55, was dewatered to 10 ft below water surface.

Reinforced Concrete Slab Adopted

After the completion of the various field examinations and tests, the majority opinion was that a solid reinforced concrete slab of proper design would withstand the chemical and wave action of the water, although porous concrete had not done so. In the engineering conferences that followed, two types of protective materials, a reinforced concrete slab and rock riprap on a crushed rock or gravel filter layer were finally adopted as suitable. There was much disagreement among the engineers engaged in the solution of the problem as to the following:

1. What should be the thickness of the proposed reinforced concrete slab and the amount of steel reinforcing?
2. What methods should be used for slab construction? Part of this work would have to be done in 4 to 12 ft of water depending on reservoir level. It was not feasible to lower the reservoirs to low-water level during slab construction because of the loss of power production that would result.
3. To what extent were repairs necessary? Should new protection extend as low as the berm at El. 55 or upward from the low-water line only? All agreed that no new protection

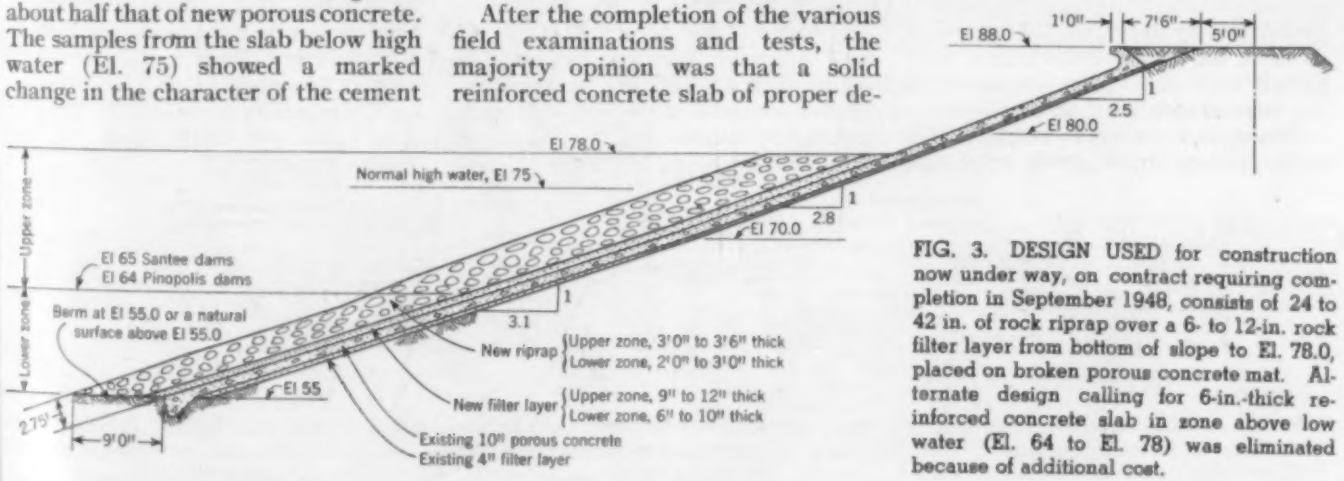


FIG. 3. DESIGN USED for construction now under way, on contract requiring completion in September 1948, consists of 24 to 42 in. of rock riprap over a 6- to 12-in. rock filter layer from bottom of slope to El. 78.0, placed on broken porous concrete mat. Alternate design calling for 6-in.-thick reinforced concrete slab in zone above low water (El. 64 to El. 78) was eliminated because of additional cost.

FRINGE OF TIMBER left standing in Santee reservoir is gradually falling. To prevent slope damage from this source, floatage is removed as it reaches shore.

was necessary from the upper limit of the wave belt (El. 78) to the crest.

4. Would rock riprap on a crushed rock or gravel filter layer stand without sliding on the slope of the porous concrete? If not, would break-up of the porous concrete prevent such sliding?

5. What should be the thickness and gradation of the filter layer materials and of the rock riprap?

The Board of Consulting Engineers, after reviewing the engineering data and the proposed alternative plans, decided that either of the following designs would be satisfactory:

1. A 6-in.-thick concrete slab extending from El. 64 to 78, reinforced with $^3/_4$-in. round bars 14 in. on centers both ways with additional bars across transverse construction joints.

2. Rock riprap 24 to 42 in. thick on a rock filter layer 6 to 12 in. thick, all to extend from El. 55 to 78, the porous concrete to be broken up from the bottom to El. 76.

The final design on which alternative bids were taken is shown in Fig. 3. This design included a combination of rock riprap in the zone below low water and reinforced concrete in the zone above low water.

When bids were opened on October 31, 1946, the lowest received were as follows:

For reinforced concrete pavement in upper zone only . .	$2,805,696
For reinforced concrete pavement in upper zone and rock riprap on rock filter layer in lower zone	$4,243,159
For rock riprap on rock filter layer in both zones	$3,822,800

A contract was let to the low bidder for the complete rock riprap job but as this bidder defaulted the contract was finally executed with the second low bidder, Grannis, Thompson & Street Co., and subsequently the contract was adjusted to provide for rock riprap in lieu of reinforced concrete pavement in the upper zone. The construction work on that contract is now under way on a schedule requiring completion in September 1948.

(*Continued on page 80*)

Sand Drains Save $750,000 in Marshy Section of New Jersey Freeway

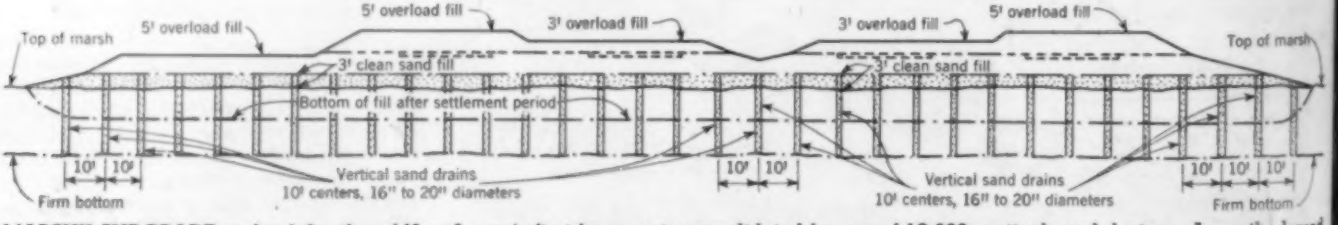
VERTICAL SAND DRAINS, in preference to excavation and fill, are being used for marshland consolidation on a 1.2-mile stretch of Route 100, New Jersey's first freeway. This method of consolidating the subgrade requires only 821,000 cu yd of borrow, 95,000 cu yd of channel excavation, 340,000 cu yd of sand blanket and 304,000 lin ft of vertical sand drains, as compared with 927,000 cu yd wet excavation, 1,268,000 cu yd borrow and 56,000 cu yd channel excavation required by the alternate method on which contractors were permitted to bid. The net saving to the state is estimated at $750,000.

The work consists of placing 18,000 units of sand drains, with minimum diameter of 18 in., spaced 10 ft apart in each direction and varying from 8 to 24 ft in depth. Although the contract does not specify the exact method of construction, the usual procedure calls for a 3-ft sand blanket through which a closed-end mandrel is driven into the underlying muck and silt to a specified depth. Sand is poured into the mandrel and the tube is withdrawn leaving the sand cylinder to act as a drain.

According to Charles M. Noble, M. ASCE, New Jersey State Highway Engineer, this method was also included in the bidding for construction of Route 3 in Secaucus, Hudson County, across the Secaucus Meadows adjacent to Penhorn Creek where sand drains as deep as 90 ft will be required to drain the underlying muck and silt.

The contract for grading Route 100 has been awarded to Construction Aggregates Corp., New York. O. J. Porter, M. ASCE, of New York and Sacramento, Calif., acted as consulting engineer for the New Jersey State Highway Department in preparation of the plans for the sand drain design.

The use of a seagoing dredge to remove salt marsh muck from another particularly difficult section of Route 100, at Woodbridge, N.J., is described by Commander Noble in the October 1947 issue of CIVIL ENGINEERING (pages 28 and 29).



MARSHY SUBGRADE under 1.2 miles of New Jersey's first freeway is consolidated by use of 18,000 vertical sand drains. In method used successfully in similar operations on West Coast, sand is poured into mandrel driven through 3-ft sand blanket and underlying muck, then tube is withdrawn leaving sand in place to act as a drain. Weight of fill compresses muck, forcing water into sand drains.

Ground-Assembled Forms Cast 312 Monolithic Exterior Columns

FORMS WEIGHING as much as 18 tons—constructed on the ground and lifted into place by crane—featured the erection in less than a year of 312 exterior concrete columns for five factory buildings at Willow Island, W.Va. These two- and three-story buildings are the major part of the plant being constructed by Turner Construction Co. for the Calco Chemical Division of the American Cyanamid Co. Other major buildings on the 1,100-acre site, 17 miles north of Parkersburg, are a power plant and a steel-frame warehouse.

In the construction sequence, footings for the columns were poured well in advance of the other operations. The column forms were erected and poured, usually four at a time, in sequence around the building. After the forms were stripped, grade beams were poured to the sill of the first-story window. Structural steel was then erected, followed by pouring of the spandrel beams.

Forms for Columns

Column forms were built up of 3-in. tongue-and-groove lumber, fastened to channel iron girts and lined with $^1/_4$-in. masonite. Typical column forms were made in two vertical sections. Corner forms were constructed in three vertical sections to facilitate stripping. A steel plate with a 1-in.-dia jacking bolt was placed in each corner of the form for leveling and plumbing.

Completely assembled on the ground with all reinforcing steel in place and boxed out for spandrel beams, girder pockets and window frames, the forms were hoisted and set in place over the footing dowels by a Manitowoc speed crane with an 80-ft boom. They were then connected at the top in series of three and four by platforms from which the concrete was poured. Cable guy ropes attached to screw anchors held the forms in place.

Concrete was poured into the forms in lifts of 12 to 14 ft through chutes of $7^3/_4$-in. steel tubing running down the outside of the form and into the column at points where there were beam pockets. Concrete was placed in four column forms in rotation, 2 cu yd at a time for typical columns and 3 cu yd for corner columns. Electrically operated vibrators were used externally on the

HEAVY FORMS 40 FT AND 50 FT HIGH (below) are assembled on ground prior to erection by crane for pouring reinforced concrete columns at site of Calco Chemical Division plant of American Cyanamid Co., Willow Island, W.Va. Reinforcement rods and stirrups are fixed in 3-in. tongue-and-groove timber forms connected to angle-iron corner posts and channel-iron girts with boxes set for girder and spandrel pockets. Intermediate and corner forms are made in two and three sections for easy stripping. Platforms connect forms at top for pouring columns in groups of three and four. Forms for pilasters and spandrels are Calco design with slight modification by Turner Construction Co.

MONOLITHIC REINFORCED CONCRETE columns (below), 6 ft 2 in. wide and 2 ft 2 in. deep, with beam and spandrel pockets, are ready for steel construction in one of five buildings of chemical plant. Grade beams for finished columns are set to first-floor window sills. At extreme right, forms assembled on ground are erected by crane over foundation dowels. In constructing 312 columns, 5,200 tons of structural and reinforcing steel were used and 36,000 cu yd of 3,000-lb concrete was poured.

STRIPPING OF COLUMN FORMS is followed by pouring of grade beams to sills of first-story windows. Structural steel for interior of manufacturing building is seen in view below. Spandrel forms made of steel I-beams and channel iron and 3-in. tongue-and-groove lumber are in place.

forms. During pouring operations careful checking by transit was required, as weather and sun affected alignment.

Approximately 15.5 cu yd of concrete was used in the typical two-story columns, 21 in the typical three-story, and 30 in the three-story corner columns. Four two-story columns were poured in about 6 hours; four three-story columns in 8 hours.

Serving as pilasters in the architectural design, the 6-ft 2-in. wide by 2-ft 2-in. deep columns are built on footings 6 ft below the first floor, with vertical reinforcement of four $1^1/_8$-in. square rods and two $^5/_8$-in.-dia round rods. In the three-story bays they rise to a height of 55 ft 1 in.; in the recessed spandrel bays the over-all height is 39 ft $9^5/_8$ in. with provisions for extra stories when required. The spandrel slabs, reinforced with $^1/_2$-in. temperature steel, are 1 ft thick and 6 ft deep.

Construction of the five units will be completed this year. One unit is about ready for production and the other four will be in operation in the early part of 1948. The buildings, designed by the Calco Division, were erected by the Turner Construction Co. of New York.

Improvised Equipment Makes Rail Pulling Profitable

PULLING EMBEDDED RAILS by special equipment and repaving damaged streets is found to be more economical by the Memphis Street Railway Co. than resurfacing the entire width of the street leaving the rails in place. Removal of the embedded rails is expedited through use of a job-improvised machine consisting primarily of a truck-mounted lever arm and winch actuated by a power take-off on the drive shaft of the truck. The cost of removing the embedded rails, including cleaning and hauling, was $18.00 per ton. Profit in the sale of reclaimed rails at $38.00 per ton was applied to the cost of repairing the damaged streets.

Four rail-removing trucks—owned by the Gorbett Welding Co., of Fort Worth, Tex., contractors on the job—removed as much as 1,500 ft of double track per day. This amount greatly exceeded the 800-ft minimum specified in the contract. The paving contractor, following the rail removal operation, cleaned out the resulting grooves and filled them with asphaltic concrete. After the filled grooves were compacted by means of a rubber-tired motor patrol weighing about 26,000 lb, a sheet asphalt paving was laid.

T-rail removal in open-track construction was accomplished through use of the "lizard" patented by A. D. McWhorter, chief engineer of the Memphis Street Railway Co. Contract prices for removing the rails were 23 cents per lin ft for removal of embedded rail and 11 cents per ft on open track construction.

T-RAIL-PULLING "LIZARD" (right) consisting of 6-in. roller on locomotive-drawn sled extracts 2 miles of single-track railway per hour. Two rails threaded over roller are pulled simultaneously as skids ride ties.

TRUCK-MOUNTED MECHANISM featuring winch-operated lever arm (below, right) and tongs (below, left) pulls 1,500 ft of embedded rail per day on contract calling for removal of 40 miles of grooved rail from Memphis, Tenn., streets. Force of pull is transferred to pavement on either side of rail through longitudinal skids attached to chassis of truck. Salvaged rails help pay for repaving damaged streets.

Good Building Codes—Properly Administered—Assure Public Safety

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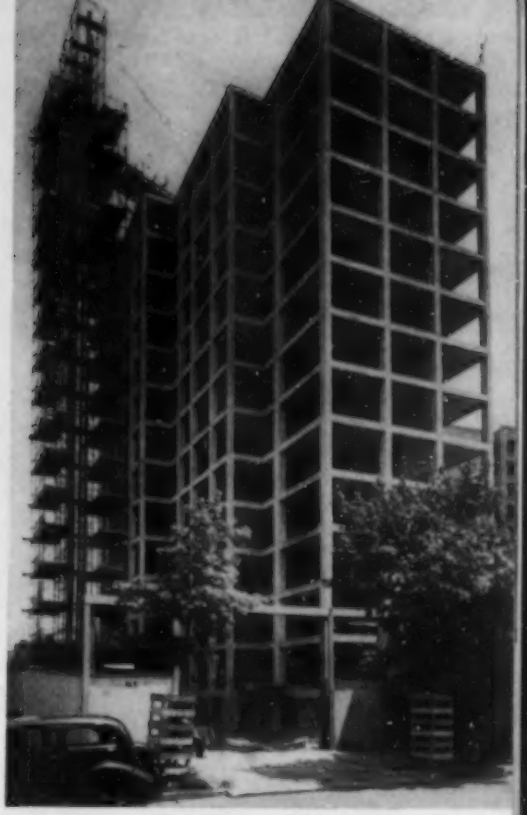
New Orleans, La.

LIKE EVERYTHING ELSE in this fast-moving world, building codes must be kept abreast of the times. It takes the cooperation of owners as well as that of architects and engineers to accomplish the objectives sought by all building codes. Practical cooperation in this respect is seen throughout the country. The purpose of a building code, necessary changes because of developments in materials and methods, proper administration of a code, and recent revisions in the New Orleans Building Code are discussed herein.



WORKING UNDER BUILDING CODE and multiple-dwelling law which did not contemplate large multi-block developments, New York City Housing Authority has shown that fireproof housing in large-scale operations need cost no more than non-fireproof construction (May 1947 CIVIL ENGINEERING, page 32). Concrete structures such as those in Clinton Housing Project, Brooklyn, N.Y., have helped solve New York City's demand for low-cost rental housing. Photo courtesy Lone Star Cement.

RECENTLY a high federal housing authority expressed the opinion that a large percentage of cities have no building codes at all; that most places which do have them, do not enforce them; and that a large proportion of existing codes have been written for the benefit of private interests. All in all, his point was that the codes should be amplified and revised in order to reduce the cost of housing. This is just a case of making a "whipping boy" out of the codes—as bad or as good as they may be.

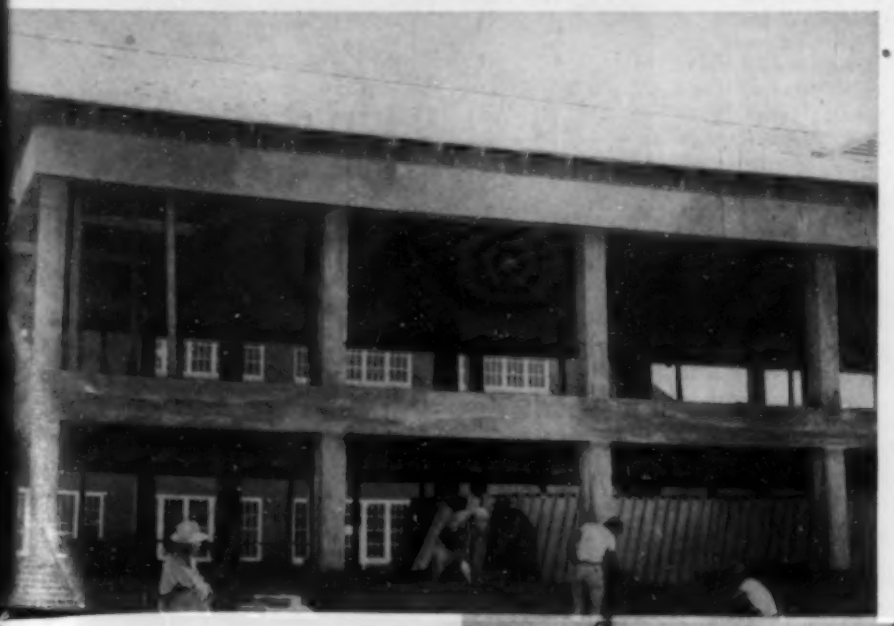
There are very few clauses in any code which materially affect the actual cost of residential construction, yet codes are the subject of almost universal criticism. We may think this is new, but it isn't; there has been almost the same amount of criticism ever since there have been building codes. Of course conditions sometimes intensify such criticism. A peculiar thing is that a very large majority of such criticisms come from people who are almost totally ignorant, not only of the purpose of codes, but of their content.

In recent months the writer has asked quite a number of building code critics if they knew what was in a building code, or if they knew its purpose. With very few exceptions their answers revealed that they knew absolutely nothing about codes except to use them in catch phrases so as to gain some form of self-advertisement or political advantage.

This does not mean that there is any building code which even approaches perfection, or that the majority of the codes in existence could not be materially improved, or that most of the abuses mentioned do not exist in some codes. Many cities and towns have no code whatever. There is always room for constructive criticism.

Code Provides Public Safety

The purpose of a building code is to provide for the safety of the public—physical as well as financial. A man cannot tell his neighbor what he is to do or how he is to live unless what the neighbor wishes to do causes inconvenience or hazard to those around him. That principle is the basis of all building codes. The best interest of the public is not always well defined, so in this, as in almost everything, there must be some compromise between the ideal and the practi-



PUBLIC SAFETY IS BASIC CONSIDERATION in preparing modern building codes or revising old ones to keep them abreast of times. Students at Howard Payne College, Brownwood, Tex., meet housing situation by building comfortable, fire-safe dormitories with student labor, under direction of competent building superintendent. Photo courtesy Lone Star Cement.

CODE REGULATIONS lag behind development of new materials and methods, but many agencies are now working toward solution to problem. Prefabricated shop building of Butler Manufacturing Co., Kansas City, Mo., is example of structural electric arc welding applied to obtain rigid construction and clean interior. Photo courtesy Lincoln Electric Co., Cleveland, Ohio.

cal. Most present-day codes provide for the safety of the public at least in some measure.

It might seem as though building codes were the result of present-day concentration of population and modern construction methods, but this is not the case. History tells us that as long ago as 2,000 B.C. King Hammurabi of Babylon issued edicts that were the equivalent of our present-day building codes. He was not specific as to types of construction or occupancy, but he was most definite as to efficiency of design, and the penalties he provided were severe, up to and including the death penalty.

Roman emperors apparently were the first to combine considerations of strength, fire-resistance and sanitation in their building code regulations. London had a building code of sorts as early as the year 1189. New York apparently started regulation of building construction in 1648.

The building of our national capital was planned and regulated not only in regard to safety and sanitation, but also as to appearance. This is a very rare provision. Present-day codes omit the consideration of appearance and limit themselves to provisions for safety.

Materials and Methods Change Codes

Until about 100 years ago, there were few changes in materials of construction, hence little was needed in the way of regulation, but in the last 100 years developments in construction materials and construction methods have necessitated the development of appropriate regulations. Developments in the building field have been gradual and progressive, being dictated by changing needs and inventions. Naturally, code regulations lag behind the development of new materials and methods, so even the nineteenth-century building codes were subjected to the same criticisms we hear today.

The ASCE, the American Society for Testing Materials, the Underwriters Laboratory and the National Bureau of Standards have been major agencies in the development of sound, basic regulatory provisions. Today many organizations are bending their efforts toward the improvement of building codes and the solution of the problem of keeping them abreast of the times.

Recent holocausts and the housing shortage have pointed up the interest in codes. Paradoxically, these two factors are apparently in conflict. The first one mentioned has led to demands for stricter regulations and the second to demands for relaxation of regulations. Actually, there is not as much conflict as would be expected. Proper safety can be provided with very little added expense, and the average code has very little to do with the cost of housing where the shortage is most acute.

If a code is to be workable, usable and effective, it must be kept up to date. New developments in construction materials and methods are appearing almost daily. Of course they cannot be accepted until proved, but the proof follows closely in many cases and it is therefore necessary for building codes to have flexibility so that they can be easily adapted to new developments. The best way to do this is to establish a Board of Appeals whose authority transcends that of the enforcement authorities. The duty of such a board is not only to interpret the code, but also to incorporate changes and improvements in it in proper legal fashion so as to keep it abreast of the times.

A good building code covers the question of safety from several angles: structural, fire, occupancy, sanitation, and special and local conditions. It will be noted that this is almost a definition of engineering. For purposes of clarity and to avoid needless repetition, codes are usually divided into general classifications pertaining to:

Administration	Occupancy and Use
Location	Electrical
Structural Features	Mechanical

PROGRAM THAT CALLS FOR COOPERATION of structural steel interests, engineers and city officials in New York City envisages use of higher stresses for structural steel, use of cold riveted and welded steel parts and introduction of many new and safe materials to save time and reduce costs. New, light-weight steel stairs in photo are installed with steel framework and put into immediate service in large-scale housing project of Metropolitan Life Insurance Co., New York, N.Y.

Briefly, the table of contents of a building code is about as follows:

- Definitions
- Administration
- Safety and Construction
- Board of Standards and Appeals
- Use and Occupancy
- Fire Limits and Requirements
- Types of Construction
- Quality and Design of Materials of Construction
- Fire-Resistive Standards
- Street Obstructions
- Elevators and Mechanical Devices
- Mechanical Equipment, Gas Regulations
- Electrical Installations and Equipment
- Sewer and Water Regulations
- Rat-Proofing
- Boiler Inspection
- Smoke Abatement, and Control of Any and All Activities Involving Public Health and Safety

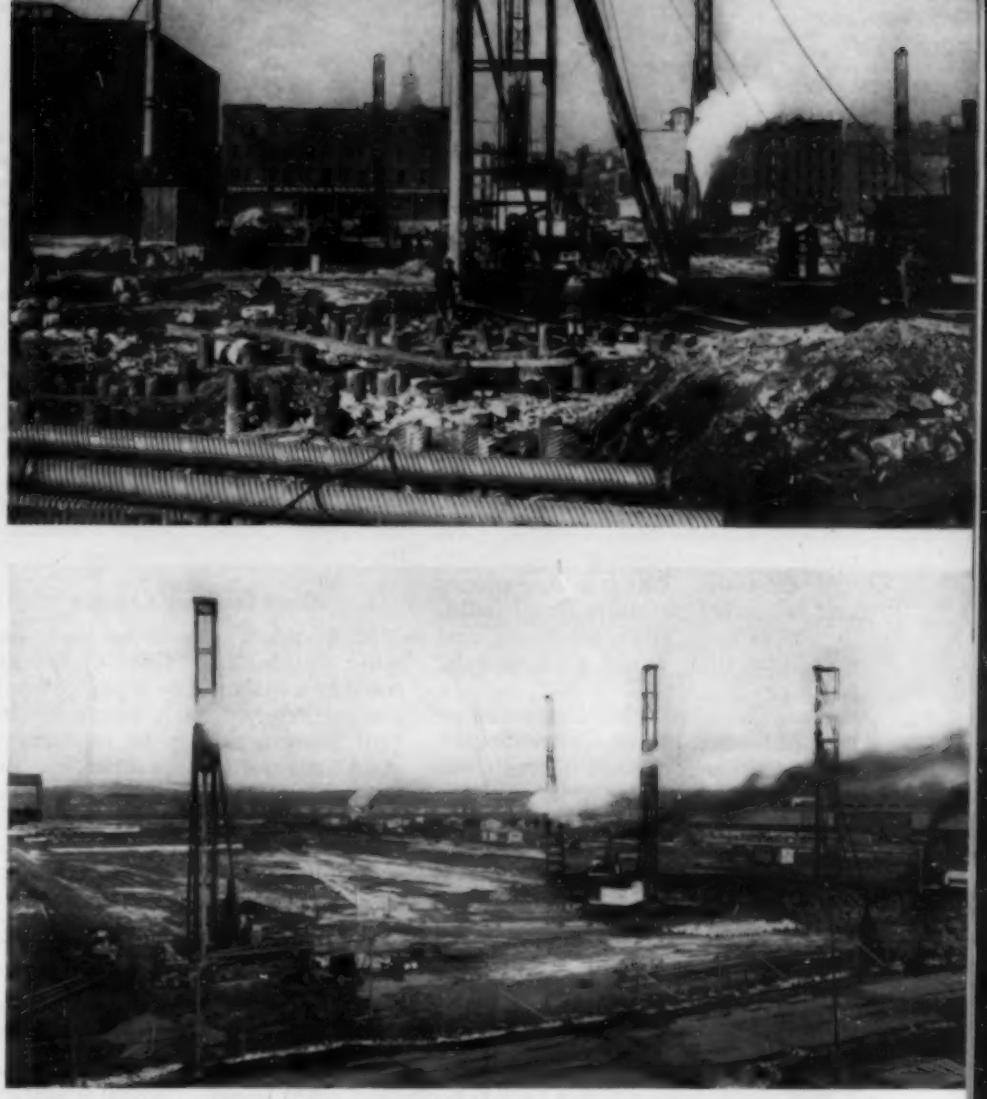
Because of the complexity of our legal setup, it is advisable to divide the code into several divisions, with a separate ordinance for each division. In this way if the legality of one ordinance is attacked, the whole code is not made inactive.

No code, however good, is of much value unless it is properly enforced. The usual tendency of well-intentioned citizens is to obey the rules laid down by proper authority. However, as soon as it becomes known that a law or regulation is not enforced, it is flagrantly violated and quickly comes into contempt. The actual performance of enforcement is 50 percent of the problem, in the writer's opinion, and the proper form of a good code is the other 50 percent.

Should Be Properly Administered

If safety is the prime purpose of a code, it follows that engineering is the basis of all codes. Moreover, any organization that has to do with construction should have a chief engineer, and this chief engineer should be the executive head of all the concern's activities which relate to engineering from the standpoint of either design or construction. It follows that a city engineer is properly the chief engineer of a municipal corporation. He is the proper executive head for the administration of the building code. On all sides it is stated that the city engineer has too much to do looking after the city, but an efficient executive is not limited in the scope of the activities he can direct.

There appears to be a definite trend toward the establishment of a new bureau or department to administer the building code. It seems to the writer that this is largely an admission of inefficiency and defeat. In many instances it is found that a new authority created for this purpose is non-technical at the top. The result is the confusion which always results when professional activities are directed by non-professional executives. The writer states, therefore, without equivocation, that the city engineer is the man who should be in active charge of the administration of all building codes.



SETTING UP OF NATIONAL CODE is complicated procedure and may take some time to complete. In writing any code, local conditions with reference to foundations, wind, earthquake resistance, insects and climate must be considered. Units in New York City's Stuyvesant Town housing project (top photo) are supported on 40,000 button-bottom piles aggregating 1¾ million lin ft. Four pile drivers (bottom photo) place cased pedestal and 12-in., 53-lb H-piles for foundation of General Electric Co. building, Schenectady, N.Y. Photo courtesy Western Concrete Pile Corp., New York, N.Y.

New Orleans Building Code

The New Orleans Building Code was not really in bad form before its recent revision in July 1947. Back in 1922 the writer was a member of the committee which drew up the original code. Public hearings were held and the work was interminable. In 1929 a not-too-bad code was published. It was revised in 1942, but the actual effectiveness of the revision was somewhat nullified by the fact that the committee had no control over the finished product. As the code stood after revision in 1942, it was as good as the average. One of its main faults, improper indexing, was corrected in the 1947 revision, and other desired improvements have been made, such as inclusion of regulations in regard to solid-front buildings, liquefied petroleum gas, etc.

One of the main changes made in the 1947 revision was in regard to pile foundations. All of the dynamic formulas for determining the carrying capacity of piles were discarded. Provision is made for actual loading of test piles, and formulas are provided for reductions due to inefficiency of grouping. The specific provision is made that no piles shall be driven closer together than 3 ft, or closer together than 5 percent of their over-all penetration. This provision was inserted as a result of experience in New Orleans and vicinity. It is definitely known that if friction piles are spaced so close together that the

cone of influence of one overlaps the cone of influence of the other, then the soil is overloaded at the points of overlap, causing subsidence and sometimes failure.

In preparing a building code, it is not deemed proper, and probably it is not legal, to refer to current issues of engineering specifications or the like, but it is considered proper, and it is very desirable to provide that compliance, for instance, with the regulations of the American Institute of Steel Construction, the American Concrete Institute, the Forest Production Laboratories and the like, should be considered as compliance with the code. This is a very proper and necessary provision in all building codes as it gives a latitude and flexibility that would otherwise be lacking.

A number of good building codes are now published in the United States. Among them are the Uniform Code of the Pacific Coast, the code of the Board of Fire Underwriters, the Southern code, and others. Efforts are being made to set up a Uniform National Code, and some progress is being made along this line. There is encouragement in the operation of the National Electric Code and the National Elevator Code. However, local conditions do not govern these two operations nearly as much as they do other parts of building construction. Therefore the job of setting up a National Building Code is complicated and may take some time. No matter what the final code turns out to be, local conditions will have to be provided for, particularly with reference to foundations, wind, earthquake resistance, insects and climatic conditions.

Good Engineering Practice

It would of course be best, and quite simple, if a "Code of Intent" could be written. One sentence would serve—merely the statement that "All construction is to conform to good engineering practice." But we are not nearly that far advanced. We may never advance that far, so we have to depend on a code of specifications in which details are set forth in as clear and concise a manner as possible.

The engineering profession has not been active enough in the preparation and activation of building codes. In many instances this work is left to lawyers, civic-minded non-professional men, politicians and the like, to say nothing of our confreres, the architects, who are all vitally interested in building codes. The architects' interest does not lie strictly in the architectural line as building codes do not regulate architecture. They only regulate the engineering incident to architecture.

On the committee for revising the New Orleans Building Code there were two architects, five engineers, one contractor, and a representative of the Fire Prevention Board.

The writer's message—if it can be called a "message"—or his plea, if it can be called a "plea"—is that the engineer take a more active interest in the safety of his community, as protected by the institution and enforcement of an efficient building code.

Dipper Handles 40 Cu Yd at 120-Ft Range

WORLD'S LARGEST DIPPER is capable of handling 40-cu yd load at maximum dumping radius of 120 ft or maximum dumping height of 80 ft. Although dipper capacity is 5 cu yd greater than previous model developed by Marion Power Shovel Co., weight of dipper, bail, handle and material load is 4 percent less. Design changes include lengthening of crowding handle 2 ft, stiff-leg 3 ft and boom 15 ft. Substitution of low-alloy structural steel for conventional mild steel in these parts accounts for 17.5 percent decrease in weight of front end. Stability adjustment, because of longer range, consists of adding small amount of ballast to shift center of gravity about 1 ft toward center of rotation. Marion "Long Boy" with "Big Bertha" dipper (below, left) is used for stripping job by Sunlight Coal Co., Booneville, Ind. Size of 40-yd dipper (below, right) can be judged by comparison with size of man in photo.

Deep Caisson Piers Support New Memphis Highway Bridge

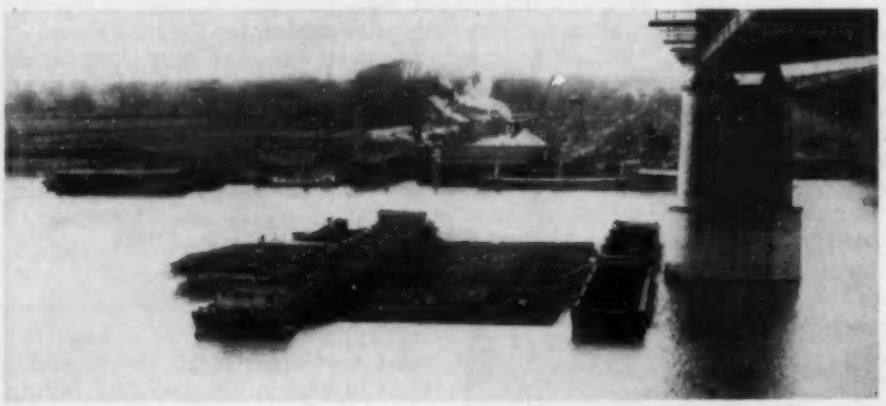
SEVEN REINFORCED CONCRETE PIERS (above) rising 225 ft above bottoms of caissons await erection of seven-span, 3,695-ft cantilever and through truss superstructure for four-lane highway bridge across Mississippi River at Memphis, Tenn. Looking from Memphis side, first four piers between river banks were founded in pneumatic caissons, remaining three by open dredging. To right of new construction are Frisco railroad bridge and Harahan railroad and highway bridge. Design and supervision of construction is by Modjeski & Masters, consulting engineers, Harrisburg, Pa. Merritt-Chapman & Scott, New York, are contractors for pier construction.

SEVEN GRANITE-FACED reinforced concrete piers for the four-lane highway bridge now under construction over the Mississippi River at Memphis, Tenn., are now ready for erection of the multiple cantilever superstructure. The 3,695-ft-long main bridge structure, designed by Modjeski & Masters, Harrisburg, Pa., for the states of Arkansas and Tennessee, is located 200 ft downstream from the Frisco Railroad Bridge (opened in 1893), and 400 ft downstream from the Harahan Bridge serving both railway and highway traffic (opened in 1916). A clearance of 109.4 ft above mean low water is provided by the river piers which are over 225 ft high from bottom of caissons to capstones.

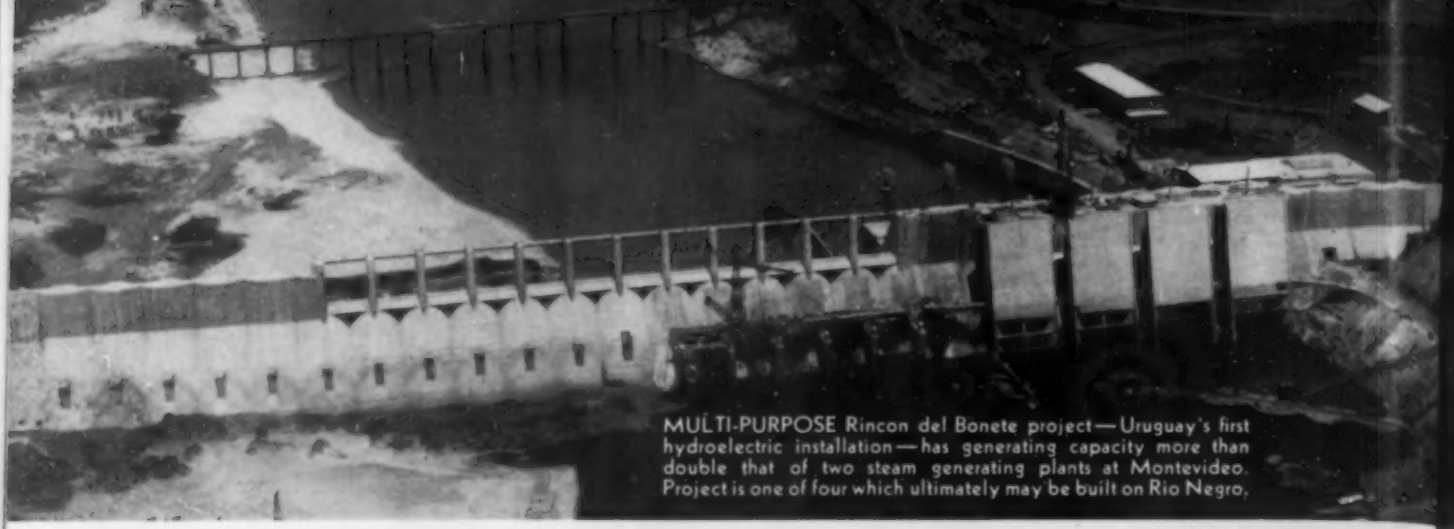
At the Memphis end of the bridge the four main piers were founded in pneumatic caissons. The three piers on the Arkansas bank were founded by open dredging. The deepest of the pneumatic caissons rests on hard blue clay at a depth of 100 ft below low-water elevation. Built on the Wolf River at Memphis, the 40× 100 by 20- to 30-ft-high steel caissons were launched on regular shipways, floated to position and tied by cable

(*Continued on page 80*)

WILLOW MATTRESSES, 250×350 ft, woven on specially built barges (below), are sunk with riprap to prepare site for sinking of two deep-water caissons. Mats are anchored by $1^1/_2$-in. cables to 20-ton concrete blocks 1,000 ft upstream. Steel caissons floated into position are brought to rest on mattresses by addition of about 2,000 tons of concrete.



OPEN DREDGING IS USED in initial sinking of main river pier (right) on Arkansas side of river before sealing off for completion of operation by pneumatic methods. Fourteen wells, 8 ft in diameter, provide shafts for excavating sand and clay. Crane in photo is placing forms for new lift of concrete. Sinking operation is protected by 150-ft-dia sheet steel cofferdam.



MULTI-PURPOSE Rincon del Bonete project—Uruguay's first hydroelectric installation—has generating capacity more than double that of two steam generating plants at Montevideo. Project is one of four which ultimately may be built on Rio Negro.

Uruguay's Rincon del Bonete Project Supplies Country's First Hydro Power

LUIS GIORGI, M. ASCE

Director General, Comision Tecnica y Financiera de las Obras Hidroelectricas del Rio Negro, Montevideo, Uruguay

FACED WITH THE PROBLEM of increasing its annual per capita electrical production from the low figure of 150 kwhr, Uruguay is rushing to completion its first hydroplant, Rincon del Bonete on Rio Negro, 150 miles from Montevideo. Work on the project, being built by an official agency of the Uruguayan Government, was originally contracted for by a German syndicate in 1937. Following interruption by the war, the Uruguayan Government made arrangements with the State Department, the Eximbank and American manufacturers to get the necessary priorities and allocations needed at that time (1941–1943) to obtain funds for materials and American services, and to contract for the manufacture of machines, equipment and materials to complete the project. The finished project, the first two units of which are now in operation, will provide a surplus of low-cost hydro energy for industrial development until about 1954.

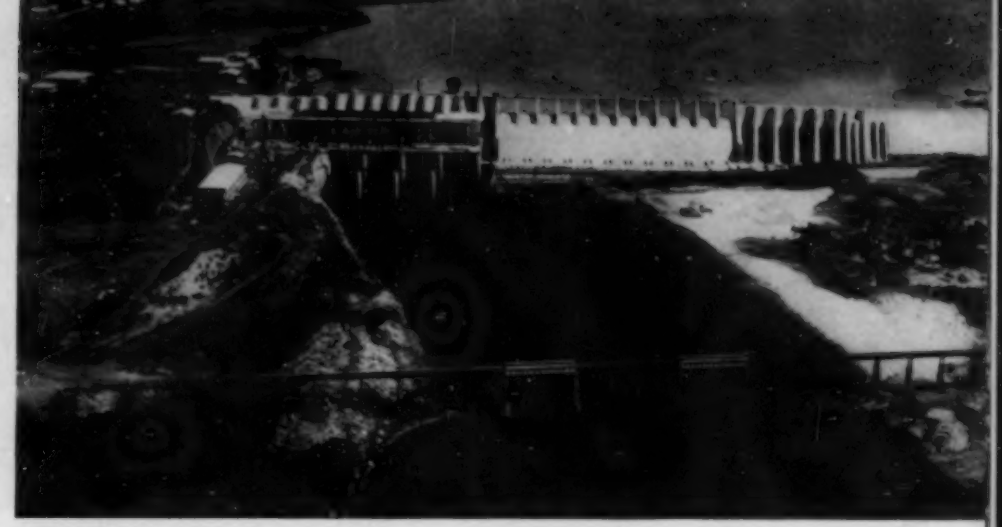
FIG. 1. RIO NEGRO (right) flows full breadth of country from Brazilian border southwesterly into Rio Uruguay on Argentina border. Location is ideal for supplying hydro power to entire country.

CONCRETE CORE of earth dam (left) forming east 305 ft of 3,846-ft structure is seen in foreground. Cofferdam on left bank of river is still seen in view showing late stages of construction.

BECAUSE URUGUAY has neither solid nor liquid fuels, the principal fuels burned in the two main steam stations in Montevideo since the outset of the last war have been corn, sunflower seed and other grains. These fuels, plus small quantities of coal available from England, were the only ones obtainable in Uruguay from the beginning of 1942 until the middle of 1945. The increased cost of fuel during the war period, and the loss of efficiency due to continued use of inadequate fuels, made the cost of operating the steam plants $25,000,000 more than in normal times. This fact alone justified the construction of the first hydroplant in the country.

At present, Uruguay has in operation the first two units of a hydroelectric project located on the Rio Negro at Rincon del Bonete, 150 miles from Montevideo. When this project is completed, it will more than double the actual capacity of the two steam generating plants at Montevideo. The Rincon del Bonete Project will have four Kaplan turbines of 45,000 hp each (a total of 180,000 hp) at 125 rpm, driving electric generators of 32,000 kva, each of 13,800 volts, 50 cycles (128,000 kva total); two overhead transmission lines each 150 miles long; one main transformer station to step up the voltage at Rincon del Bonete; two

transformer substations and two other 31.5-kv substations at Montevideo; and more than 45 miles of underground 31.5-kv cables interconnecting these substations in Montevideo. One of the transformer substations will link the steam plants with the hydro project. All the power generated at Rincon del Bonete will be sent, for the time being, to the city of Montevideo whence it will be fed into the distribution network of the city and to the transmission lines spreading out from it and supplying the many small towns in the area, some of them 80 miles distant from the capital.



ROUND-HEAD BUTTRESS TYPE DAM with spread footings is used for highest section where foundation rock is of poorest quality. Downstream view of dam shows powerhouse at left, spillway section in center and four intakes at right. Construction bridge is in foreground.

Project Started by Germans

Construction of the Rincon del Bonete Project was started in 1937 by a German syndicate which built most of the dam and the foundations of the powerhouse; manufactured, supplied and installed the penstocks, trashracks, draft tubes, and speed rings for all four units and the generator supporting ring for three units; and supplied the intake roller gates and draft-tube stop logs. No work on the powerhouse superstructure, except the control house, was completed by the syndicate. The rest of the turbine parts, generators, and other electro-mechanical equipment were partially completed in Germany, but delivery was not possible.

In May 1942, the Uruguayan Government canceled the contract with Germany and made an agreement with the U.S. State Department, through which the American Government authorized American manufacturers to build equipment and supply materials to finish the Rincon del Bonete Project. At the same time, the Export-Import Bank of Washington granted a loan of $12,000,000 to pay for equipment and materials.

The American manufacturers started work on the project in the beginning of 1943. The main manufacturers engaged in this work are S. Morgan Smith, York, Pa., for the hydro turbines; International General Electric, New York, N.Y., for the electric generators; Westinghouse Electric International Co., New York, for the transformers, circuit breakers, switchboards and miscellaneous electrical equipment; General Cable Corp., for the overhead transmission line, conductors and underground cables; U.S. Steel Corp., New York, for the transmission-line towers and several steel structures; Delta-Star Electric, Chicago, for the high-tension substation structures; Dravo Corp., Pittsburgh, Pa., for the spillway gates; Harnischfeger Corp. for the Rincon del Bonete powerhouse cranes; and a few other firms supplying minor equipment. The Harza Engineering Co., Chicago, was appointed to act as consulting engineers for the job. The project is being built by Rione (Comisión Técnica y Financiera de las Obras Hidroeléctricas del Rio Negro, Uruguay), an official agency of the Uruguayan Government.

In 1947 the consumption of energy in the interconnected system within a radius of 80 miles from Montevideo, which will be partially supplied by the Rincon del Bonete Project, will be about 400,000,000 kwhr per year. 320,000,000 kwhr will be supplied by the Rincon del Bonete hydro plant and the rest by the two steam plants, which have 90,000-kw installed capacity. It is expected that consumption will increase by 1954 to about 537,000,000 kwhr, 89 percent of which will be produced by the hydroplant, leaving the other 11 percent to be produced by the steam plants.

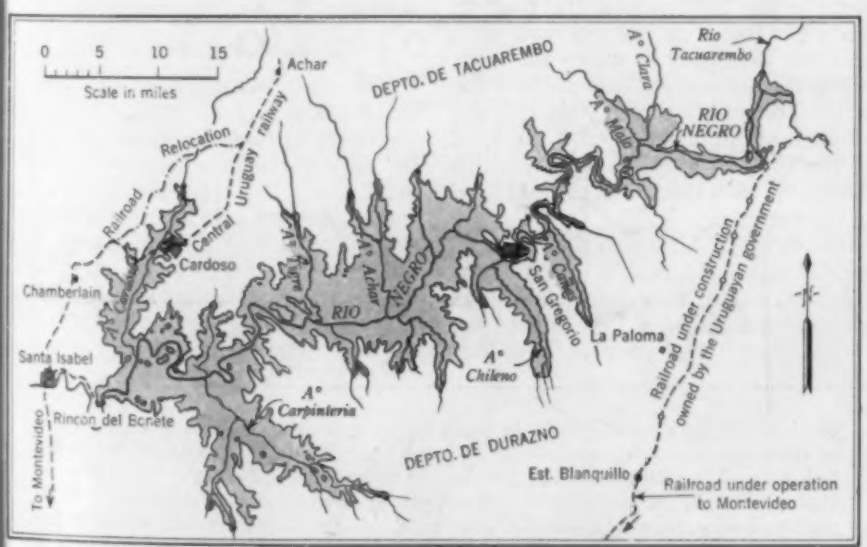


FIG. 2. AVERAGE ANNUAL RAINFALL on Rio Negro is high, but long severe droughts make adequate storage essential. Rincon del Bonete project provides 100-mile-long navigable lake above dam and supplies water for year-round navigation on 245 miles of river below dam.

River Flow Varies Widely

The Rio Negro flows entirely across Uruguay from the Brazilian border on the northeast, southwesterly into the River Uruguay, which forms the boundary between Uruguay and Argentina on the southwest. The total length of the Rio Negro is about 500 miles and the total drainage area is 26,400 sq miles. The drainage area at Rincon del Bonete is 14,650 sq miles. The average annual rainfall on the watershed is 45.4 in. a year, but there are very long and periodically severe droughts. The maximum registered flow is about 196,000 cfs and the minimum is only 715 cfs. For this reason, storage of water for the project at Rincon del Bonete is

FIG. 3. BOAT each line and staggered with reference

POWERHOUSE INTAKE, spillway and bulkhead portion of dam with lengths of 289 ft, 533 ft and 405 ft respectively, are of round-head buttress design. Remaining 2,308 ft of structure at both ends of dam is of gravity design. Modern village (foreground) provides comfortable living quarters for employees and workers.

very important. The minimum temperature in the watershed area is never below 32 deg F, and the maximum never exceeds 96 deg F. The reservoir has a normal level of only 263 ft above sea level and its extent at that level is 442 sq miles, the normal storage volume being 7.5 million acre-ft. The minimum reservoir operating level will be 235 ft and the maximum 273 ft, a variation of 38 ft.

Other Hydro Projects Planned

From the map of Uruguay (Figs. 1 and 2) it can be seen that the Rio Negro is very well situated to supply the entire country with electricity, because it divides it into two almost equal parts. The Rincon del Bonete Project, which is approximately in the center of the country, is one of four possible hydro projects which may ultimately be built on the river. Proceeding downstream, these projects are:

Name	Distance from River Mouth (Miles)	Approx. Installation, Kw
Rincon del Bonete	245	128,000
Balgorria	192	84,000
Paso del Puerto	128	139,000
Yapeyú	84	107,000

There are two other possibilities in the upstream direction, one the Rio Negro and the other on its main tributary, the Rio Tacuarembó. At present no study of those two possibilities is in prospect. The other four projects, including the Rincon del Bonete, will be able to produce 1,500 million kwhr annually, the expected demand in Uruguay as of 1960.

The present project, Rincon del Bonete, creates a very large storage reservoir, which will be economically utilized when the other three projects are built. The project is multipurpose; although it was basically designed for power, the dam provides a navigable lake 100 miles long and permits navigation along the 245 miles of the river between the dam and the mouth of the river at 7-ft draft for 300 days a year. Previously the river could be used for navigation only in the winter, and even then no more than 50 days a year.

Boat Transfer Takes Place of Lock

Since there is no lock on the dam, Rione has built a boat transfer at the throat of the bend made by the river, so that boats can pass from the reservoir to the downstream side of the dam, or vice versa. The name of the project, Rincon del Bonete, is derived from this bend (see Fig. 3). By means of a special railroad car and boat hoists, the transfer takes boats to a turntable at the top of the hill. Here, the direction of the boat is reversed before it is moved down to the river on the other side. Thus the stern is the last part of the boat to leave the water on the reservoir side, and the first part to enter the river below the dam on the other side of the hill. The length of the boat transfer track is about 2,600 ft, and the level of the top of the hill is 306 ft, which compares with the 263-ft normal level of the reservoir.

Boats up to 110 gross tons in dead weight can be handled by the boat transfer. The reason for building a transfer instead of a lock is that the latter would cost about $1^1/_2$ million dollars, and the boat transfer cost only $^1/_4$ million. It is considered that the boat transfer will be satisfactory until the development of navigation justifies the considerably larger expenditure for a lock. In order to facilitate lock construction at some future date, steel piles were left embedded in the dam to permit the building of a cofferdam, which will be necessary before part of the dam can be blown out to make room for the lock.

The maximum flow considered in the project is about 325,000 cfs; the maximum spillway capacity under that flow is 160,000 cfs; and the rise of the reservoir above normal level at this flood with this spillway capacity will be 9.2 ft. Assuming that the reservoir is at normal level (263 ft) when the flood starts, the maximum assumed flood peak will be reduced to 49.4 percent. Thus the Rincon del Bonete installation may also be considered a flood-control project.

Spread Footings in River Bed

The dam has a length of 3,846 ft and is about 137.4 ft high. It is completely constructed of concrete except for 305 ft of earth dam with a concrete core at the east end. The foundation rock is basaltic lava with a varying degree of soundness. For the highest section in the river bed, where the foundation loading would otherwise be greatest, and where the rock is of poorest quality, a round

URUGUAY, the smallest country in South America, has a surface area of about 72,000 sq miles and a population of almost three million. Besides Montevideo, the capital, with a population of 800,000, the country has more than 18 cities with populations ranging between 10,000 and 45,000. Its many industrial plants, such as meat and vegetable packing houses, weaving and textile factories, etc., industrialize the products from the two main sources of livelihood—cattle raising and agriculture. Uruguay also has thriving cement plants and rubber tire and tube factories, which have increased its industrial capacity considerably within the last 15 years.

FIG. 3. BOAT TRANSFER 2,600 ft overland, from reservoir to point on river below dam, is substitute for lock to be built when navigation warrants 1½-million-dollar expenditure.

buttress-head type dam with spread footings, originally designed by Noetzli, was adopted to minimize the unit foundation loads.

The buttresses, 6.6 ft thick, spread to 41 ft in order to form the round heads. This type of construction is used for the powerhouse intake, the spillway and a bulkhead portion in lengths of 289 ft, 533 ft, and 405 ft, respectively. The remainder of the dam, adding up to 2,308 ft at both ends of the aforementioned sections, with the exception of short transitions, is of gravity design.

When the first few buttress heads were poured, superficial shrinkage cracks developed, which tended to throw doubt on the theory of this design. Thereafter, to avoid further cracks, cooling coils were placed in the center of each buttress, causing the center to cool as quickly as the exterior. Furthermore special cement was used to cut down the heat generated during setting. All the cement, including the special kind, was manufactured in Uruguay.

A copper U-strip was used to seal the 1-in. space left between buttress heads. This space was later dry-calked with cement mortar to prevent the buttresses from spreading as the result of water pressure in the shrinkage cracks. This remedy is believed to be completely effective.

Foundation Thoroughly Grouted

Thorough grouting, which was of prime importance because of the imperfect quality of the foundation, was done in two lines of holes spaced four meters, or about 13 ft, apart in each line and staggered with reference to the holes in the adjacent line, so that each hole was about 8 ft from every other hole.

Grouting was done in steps each 13 ft in depth. Holes, about 3 in. in diameter, were drilled with calyx shot drills to a depth of 13 ft below the concrete cutoff and grouted. As soon as the cement had hardened sufficiently, the holes were redrilled and regrouted to final refusal, which sometimes required several cycles. Then the holes were extended an additional 13 ft in depth and again grouted, this time with a rubber packer to limit the grout to the newly drilled extension of the hole, repeating the process until the total of 80 ft below the foundation was reached.

By omitting the wings of the buttress heads at the bottom, five openings for passing the river during construction were left under the spillway portion of the dam. The buttresses were also extended and provided with stop-log grooves in the upstream direction to serve as closing piers.

Because of seasonal river stages and the necessity of relocating about 16 miles of railroad, closing could not be safely started until about December 1944. Finally, in December, blocks of concrete were poured behind the protection of stop-logs into the five wedge-shaped openings (approximately 25 ft high by 35 ft wide). The last sections were poured while the river flowed through one of the three turbine penstocks (with its scroll case and draft tube) that was not in use at the time.

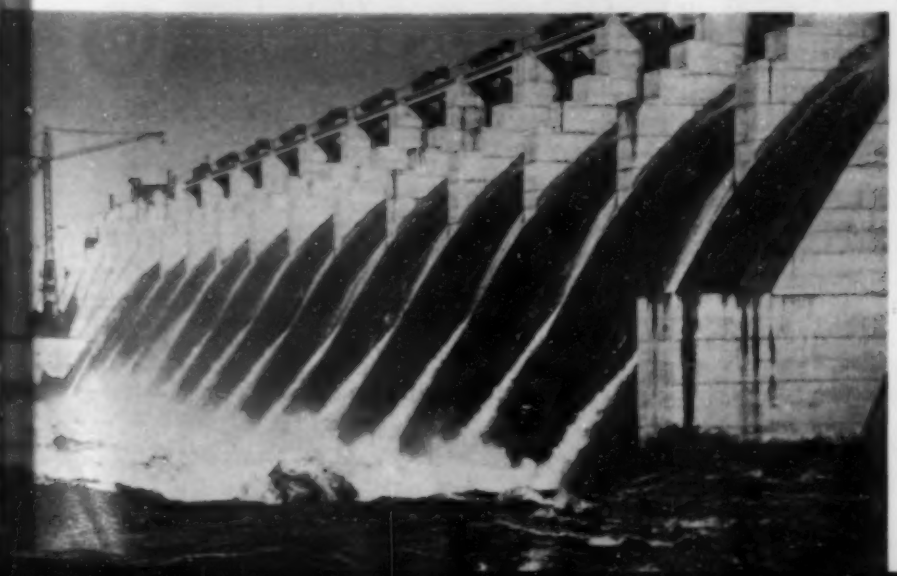
German and U.S. Methods Differ

Complete lining of the draft tube with steel plate from the turbine around the elbow, and horizontally to the tail gates, is the only noticeable characteristic which differentiates the German embedded parts from similar United States manufactured equipment. The standard United States practice is to line only about two or three draft-tube diameters in the straight vertical cone below the turbines.

Unlike the usual short United States pit liners, the German pit liners, made of welded steel, are extended up to the generator floor level and adapted as bases for the generator. Sometimes this is done in the United States, especially for high heads. At Rincon del Bonete there is an initial effective head of about 92 ft. Therefore the available diameter of base, to which the generators of United States manufacture had to be fitted, is greater than for standard United States design. The runaway speed problem, thus accentuated, was solved by adopting a slower and more efficient operating speed of unit, at very little increase in price. The German design speed of 136.4 rpm was decreased to 125. This slower speed had previously been cited by the German report on the project as preferable, but had been rejected because of increased generator cost.

A substation mounted on a compact tailrace platform on nearby river piers, permits energy to be stepped up to 161,000 v. From it electrical energy is transmitted over a distance of approximately 150 miles to Montevideo through hollow-type HH copper conductor on two single-circuit steel tower lines 300 meters (912 ft)

FIRST GENERATING UNIT of project is put in service during ceremony attended by workers and their families. Generator rotor and shaft for second unit are seen in assembling room of powerhouse in foreground.



FINISHED RINCON DEL BONETE DAM—first two generating units of which are now in operation—is big factor in plans for industrialization of Uruguay. Spillway of dam is pictured discharging 79,000 cfs. Powerhouse is seen in left background.

apart, except for 12 miles of double-circuit tower line in the suburbs of Montevideo where right-of-way is expensive. As only copper was available owing to wartime restrictions on aluminum, type HH copper conductor of 296,000 cir mils was adopted for this project. Because timber for 65-ft poles is unobtainable in South America and shipping space from the United States is at a premium, steel towers were authorized.

The voltage of the overhead lines, which terminate at the northern substation in Montevideo, is there stepped down to 31.5 kv and distributed to load centers in Montevideo over a 31.5-kv underground network. The principal part of the network is like a square with a diagonal connecting the north substation at one corner directly to the steam-plant substation at the south corner. The other two corners represent substations "G" and "J," one on the east and the other on the west side of the city. These two substations are now served by the steam plant through two sides of the square. Other sides of the square serve to feed these substations with the hydro power from the north substation. From the north, "J," "G," and steam substations, the 31.5/6.3-kv network substations are supplied.

Air-blast circuit breakers on the 31.5-kv system were adopted to conform with the prevailing tendency of avoiding the necessity for importing oil. Indoor location was decided on for these breakers because the outdoor type was still in the experimental stage in the United States at that time. Outdoor space was allowed for the 161-kv breakers in both the hydro plant and north substations. These breakers will be installed early in 1948.

Saving in Critical Materials

By employing forced-oil-cooled transformers at the hydroelectric station to cut down size and weight of

(*Continued on page 80*)

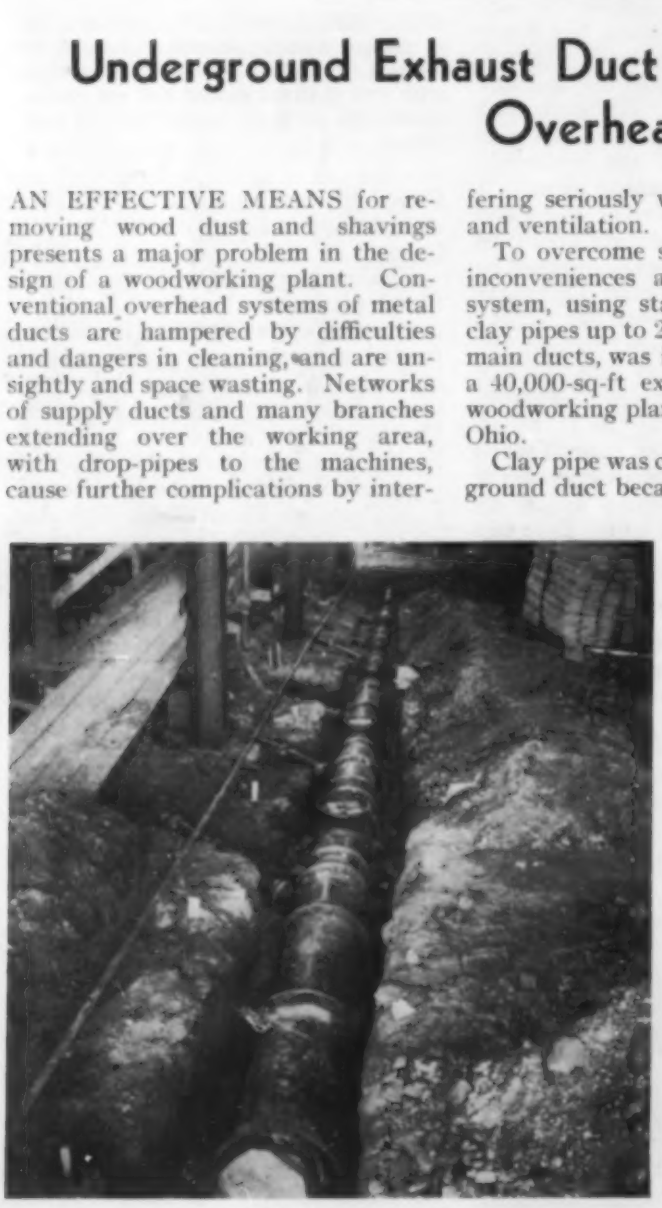
Underground Exhaust Duct Eliminates Inconveniences of Overhead System

AN EFFECTIVE MEANS for removing wood dust and shavings presents a major problem in the design of a woodworking plant. Conventional overhead systems of metal ducts are hampered by difficulties and dangers in cleaning, and are unsightly and space wasting. Networks of supply ducts and many branches extending over the working area, with drop-pipes to the machines, cause further complications by interfering seriously with proper lighting and ventilation.

To overcome such difficulties and inconveniences a new underground system, using standard-size vitrified clay pipes up to 21 in. in diameter for main ducts, was installed recently in a 40,000-sq-ft extension of a large woodworking plant located in Akron, Ohio.

Clay pipe was chosen for the underground duct because of its resistance to the moisture and tannic acid which form in damp sawdust. Further, clay pipe is practically impervious to erosion and to penetration of wood particles coming into contact with the duct walls at high speed, thus reducing friction losses in the system to a minimum.

The fan-operated exhaust system creates an air current of 13,000 cfm—a velocity of 51 mph through the ducts.



VITRIFIED PIPE SYSTEM (left) is laid below ground as exhaust duct for wood dust and shavings in 40,000-sq-ft extension of woodworking factory in Akron, Ohio. Lateral pipes (right) of lesser diameter connect machine risers to main 21-in.-dia ducts. Clean-outs at regular intervals, flush with floor, provide for cleaning of ducts to prevent clogging. Piping is laid at minimum depth of 8 in. from surface of 4-in. concrete floor.

Arch Roof Construction Provides Large Column-Free Area

CHOSEN FOR ITS EFFICIENCY in providing the large column-free area required to maneuver modern fire-fighting equipment, a thin shell arch-type reinforced concrete structure to be used by the New York Fire Department for motor vehicle and equipment repair is nearing completion in Long Island City, N.Y.

The central interior portion of the building consists of an unobstructed area 121 × 490 ft. The height to the crown of the curved roof from the finished floor is 35 ft, and at the springing line the vertical clearance is 12 ft. Flanking the central structure along either side for the full 490 ft are two 39-ft-span lean-to's, also of concrete shell construction. The lean-to spans provide space for woodworking, foundry, upholstery and various other shops. At both ends of the main portion of the building are two-story conventional beam-and-slab type structures for office and storage space.

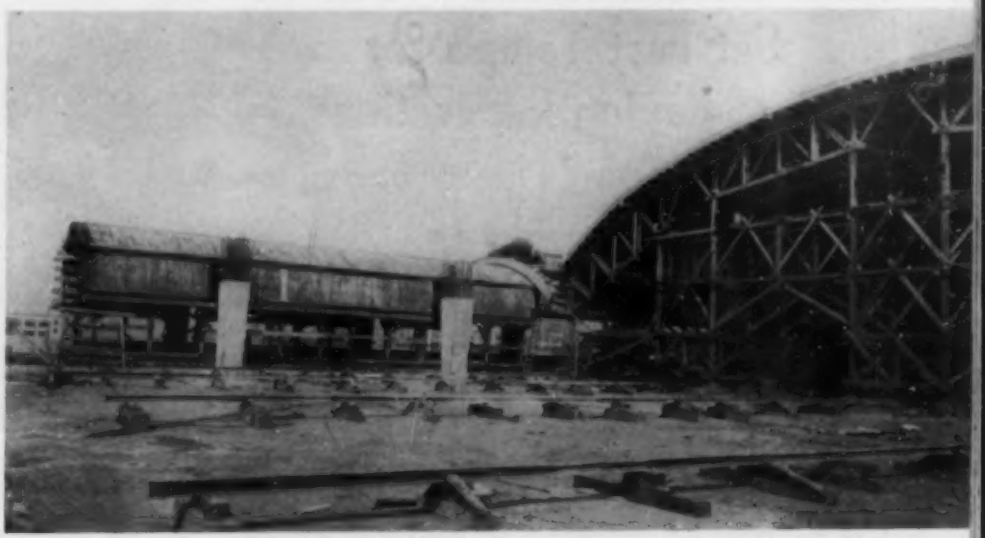
In general, the roof and its supporting structure consist of a series of similar monolithic units. The superstructure of each unit is made up of a thin curved slab, two supporting arch frames, and small ribs along the free edges of the shell serving as stiffening members. Each unit is 70 ft long (measured longitudinally). The supporting arch frames are spaced 35 ft on centers with a 17-ft 6-in. cantilever at both ends of each arch unit.

All main arch frames, 5 ft 6 in. deep and 2 ft wide at the crown, with construction joints on the column at the springing line, are hinged at the floor level, the horizontal thrust being carried to tension ties placed in trenches beneath the floor slab. These ties are prestressed to the dead-load thrust by means of hydraulic jacks as the centering is removed.

To provide a smooth ceiling the arch ribs are placed outside the roof slab which is $3^3/_4$ in. thick increasing to 6 in. where it frames into the sup-

(*Continued on page 80*)

REINFORCING FOR $3^3/_4$-in.-thick slab consists of welded wire mesh with additional reinforcing at critical points. Supporting arch ribs, 5 ft 6 in. deep and 2 ft wide at crown, are located above roof slab to give unobstructed interior. Concrete vibrators are used to insure uniform placement of high early strength cement for roof slab and ribs.



TRAVELING FALSEWORK constructed for first unit is lowered an inch or two by means of screw jacks and moved forward for pouring of adjacent units. In background of photograph, falsework for lean-to has been moved into position for next pour. Hinged edges of forms are lowered to clear columns as falsework is moved out.

UNOBSTRUCTED INTERIOR (below, left) is 490 ft long by 121 ft wide, with 35-ft clearance from floor to crown of arch. Lean-to, arch-roof workshop areas, 39 ft wide, are seen on each side of main arch. Exterior-rib design makes smooth ceiling possible. General arrangement of large and small shell structure is seen in aerial view (below, right). Stiffener ribs at ends of cantilever projections, 17 ft 6 in. either side of main arch units, can be distinguished from main ribs. Openings in roof shell provide for chimney, skylights or ventilators.

EQUIPMENT POOL for fast-moving operations on ordinary pipeline spreads includes many specially designed machines, adequately powered to handle their particular phase of the work. Ditching and welding machines—essential pipe-laying equipment—do not appear in above picture of Williams Brothers Corp. yard at Neoga, Ill.

DIFFICULT TERRAIN presents no insurmountable obstacle in constructing 20-in. pipeline of East Ohio Gas Co. View shows trench immediately before backfilling.

New Machines and Methods Set Fast Tempo for Pipe-Laying Operations

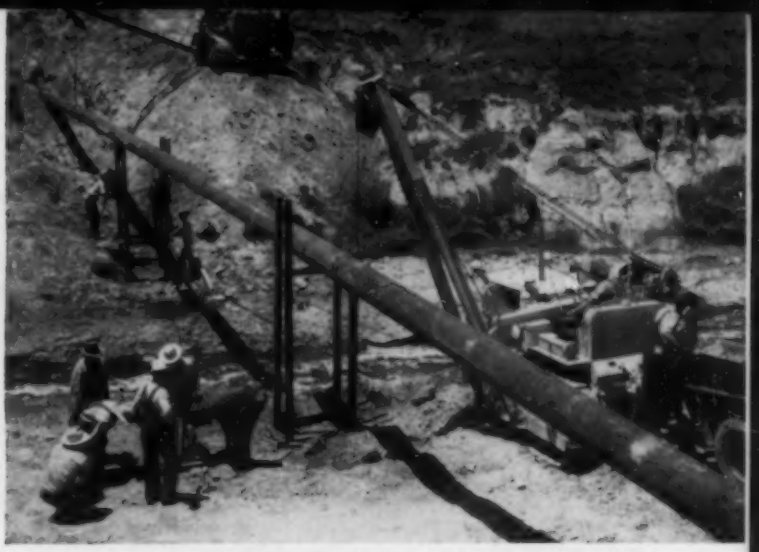
MODERN METHODS FOR CONSTRUCTING the pipelines that carry vital supplies of oil and gas over thousands of miles of rugged terrain call for a varied assortment of special equipment—machines built to perform difficult assignments on fast-moving jobs.

In combating time, the elements, stubborn rocks and loose sand, pipeline crews must do more than dig trenches and lay pipe. Men and machines must clear rights-of-ways of trees and brush; hills and streams must be crossed and paths made for proposed trenches. These

DIESEL-POWERED BACKHOE (above) digs trench in rocky soil on 300-mile 8-in. gas line between Marcus Hook and Midland, Pa.

SIDE BOOM with 6-ft extension (below) handles 20-in. gas line in ditch at river crossing near Limon, Colo., on section of Colorado Interstate Gas Co. line from Lakin, Kans., to Denver, Colo. Distance covered daily by J. R. Horrigan Construction Co., Inc., of Houston, Tex., is 8,000 to 10,000 ft.

MAMMOTH DITCH DIGGER, weighing approximately 50 tons, cuts ditch 2.5 ft wide by 9.5 ft deep at rate of 7.5 ft per minute. Equipment, powered by Caterpillar Diesel D 13000 engine, is intended for Bessarabia where Williams Brothers Corp., designers and fabricators of machine, have contract for oil pipeline.



LARGE PIPELINE—20 in. in diameter and weighing 90 lb per ft—is removed from creek bed because of excessive corrosion caused by seepage of waste waters from steel mill upstream. Crane and side-boom equipped tractors (above, left) place pipe on supports consisting of railroad rails driven into ground. Pipe rests on short rail sections welded to uprights (above, right). Crossing is on line of Colorado Interstate Gas Co. near Pueblo, Colo.

operations, plus the task of supplying a fast-moving project with materials of construction, add many pieces of equipment to the machines essential to pipe-laying operations.

Accompanying illustrations show a typical equipment pool for an ordinary pipeline spread and illustrate several difficult operations which have become routine through the use of adequately powered, specially designed machines.

The important role played by modern equipment in expediting removal of a 20-in.-dia gas pipeline from beneath a swift-flowing creek to overhead supports to provide trouble-free uninterrupted service to users is also shown in accompanying views.

COPING AND WRAPPING operation (above, right), following that of cleaning and priming, immediately precedes backfilling of trench. Ample power and positive control permit careful handling as pipe settles into trench. Line will carry natural gas to towns between Viking and Red Deer, Alberta, Canada.

LARGE DITCHER (right) is practically suspended by tow cables from winch-equipped tractors at top of slope. Work is that of Williams Brothers Corp. laying 20-in. pipeline for East Ohio Gas Co.

THROUGH KNEE-DEEP MUD covering underlying rock that must be blasted (below), compressor is moved into place. D7 tractor equipped with Hyster winch is used by Whitaker Contracting Co. for miscellaneous hauling and clearing as well as for hauling pipe-stringing trucks up and down heavy grades on 8-in. gas line between Marcus Hook and Midland, Pa.

Grass Stabilizes Sand on 4,900 Acres of New York's Idlewild Airport

NEW YORK INTERNATIONAL AIRPORT, located at Idlewild in the southeast corner of the Borough of Queens, has just recently acquired its sixth runway. When completed, this giant airport operated by The Port of New York Authority will be nine times as large as LaGuardia Airport. Already $60,000,000 of city funds have been invested in the construction of the project since its inception in April of 1942. The six concrete runways, which vary in length from 6,000 to 9,500 ft, are 200 ft wide and are built of reinforced concrete 12 in. thick. Extensive drainage, water supply and communication systems are nearing completion; 1,600 houses formerly in the construction area have been removed from the airport; and nearly finished is an underpass that will separate taxiing planes from the automobiles entering the central area.

MADE UP LARGELY of marsh and meadowland, the original airport site at Idlewild has been covered with 65,000,000 cu yd of sand fill dredged from Jamaica Bay—the largest hydraulic-fill operation of its kind ever undertaken. From the beginning, this huge quantity of sand, transferred from the bottom of the bay and spread over the field's 4,900 acres, has presented a problem in stabilization. The large flat expanse is subject to winds from all directions and the dry sand is quickly set in motion.

Only a complete vegetative cover such as beach grass can hold the drifting, migrating and shifting beach sand. The entire history of sand stabilization along the shores of Long Island and along similar stretches of seacoast as well as extensive research, experimentation and comprehensive plantings of thousands of acres at Jones Beach, Fire Island and other seashore localities, have borne out the fact that sand control can best be achieved by means of this native wild grass supplemented by a small percentage of poverty grass.

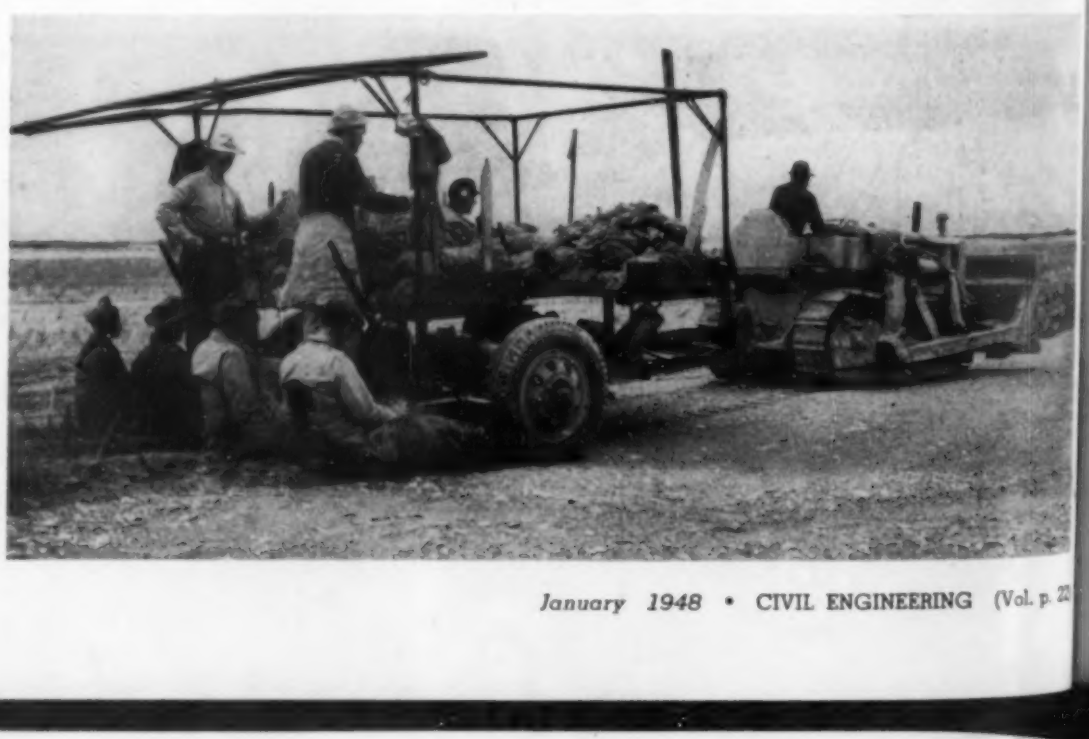
Beach Grass Has Widespread Use

The stabilization of sandy areas along both seacoasts of the United States and Europe has been successfully handled for many years by digging, dividing, and replanting beach grass (*Ammophila arenaria* and *A. breviligulata*). The early farmers along the Massachusetts coast restrained the movement of sand dunes by planting this grass and were consequently relieved of the payment of taxes. Along the Pacific coast in the vicinity of the Golden Gate, in Oregon near the mouth of the Columbia River, and in other coastal places beach grass has been used to halt the inland movement of sand dunes and subsequent devastation of valuable forests and agricultural lands (see Circular No. 660, U.S. Department of Agriculture).

Lands in New Zealand that were overgrazed by sheep and subjected to sand movement were planted with beach grass which arrested the movement of shifting sand across fertile lands. On the North Sea coast along the low-lying shores of Holland, Belgium and Germany, this grass has been used to stabilize shifting sands. On Long Island in recent years it has been planted to retain sand dunes along the seacoast. Sand pumped from the bay bottoms has been stabilized to make usable land in connection with the development of Jones Beach State Park, the Ocean Boulevard and both causeways leading to Jones Beach. In Jones Beach alone, over 3,000 acres of beach sand were successfully stabilized with beach grass.

Since its earliest use, the only improvement in the handling of beach grass has been the development of the multiple-row planting machine which has successfully replaced hand methods for large-scale operations such as the one now in progress at New York International Airport. This machine is an adaptation of the tobacco planter used in the Connecticut Valley, and the cauliflower planting machines in common use on Long Island.

Beach grass when planted with proper spacing and vigorous divisions of plants not only stops sand from blowing by lifting the wind to the tops of the plants (approximately 18 in.) but also, when left to grow un-



SIX-ROW beach grass planting machine is adaptation of tobacco and cauliflower planting machines in common use. Machine can plant 20,000 beach grass plants on one acre in about two hours as compared with same coverage by 20 men in an eight-hour day.

SAND FILL AT NEW YORK INTERNATIONAL AIRPORT at Idlewild—spread over field's 4,900 acres and subject to winds from all directions—is stabilized by planting of 10 percent poverty grass and 90 percent beach grass. Photographs show (left) grass three months after planting and (right) 15 months after planting.

disturbed after planting in the proper season, results in a permanent mat of vegetation that prevents the movement of sand. It is only when planted areas are disturbed by storms, high tides, hurricanes or construction operations, that the sand is once again vulnerable to erosion by wind. Under such circumstances speedy replanting is necessary to prevent blowouts and migration of dunes.

Beach grass when properly planted will grow unassisted by fertilizer, and for this reason fertilization was omitted at the New York Airport. Fertilization is used for the primary purpose of forcing the grass into vigorous growth in order to make available local collecting areas for plants when their transportation from outside collecting sources presents difficulties. It is also practiced in soil conservation projects where fresh supplies of plants are needed annually for repairs to storm-damaged dunes. Of course the benefits of fertilization in establishing local collecting areas can be realized only after the planting work has been completed.

Consideration was also given at New York Airport to the stabilization of wind-blown sand surfaces by treatment with oil sprayed from tank trucks or other equipment. A sample plot was tried but it was found that as soon as the volatile oils evaporated, the bitumen dried out, cracked, flaked and blew away. Frequent treatments with oil will stabilize sand for a given period, but it is a very costly procedure and will not produce permanent stabilization. This method will also interfere with the subsequent planting and growing of beach grass to obtain permanent control.

Poverty Grass Also Used

Poverty grass (*Andropogon Virginicus* var. *littoralis*) is native to the sandy plains areas of the Atlantic States and is common on the Hempstead Plains and other sandy loam areas of Long Island easterly to Montauk. The variety *littoralis* is native to the seashore and is found very extensively along the Ocean Boulevard and causeways to Jones Beach. During the 20 years of soil stabilization work along the ocean bay and sound fronts, the Long Island State Park Commission has stabilized more than 4,000 acres.

The first step in stabilization work was the planting of beach grass (*Ammophila arenaria*) by hand planting or machine methods. It was observed after about ten years that this grass made a less vigorous growth when planted in coarse sand or when the sand was no longer in movement. With the lessening in vigor of some of the beach grass plantings it was observed that poverty grass was seeding and spreading very rapidly until now it is widespread throughout Jones Beach. Poverty grass was collected and planted by the New York State Park Commission in a few areas on Southern State Parkway 13 years ago and made a satisfactory growth.

(*Continued on page 78*)

Highway Proves Adequate for Heavy Haul

TOO WIDE FOR TRANSPORTING BY RAIL, 31-ton half-section of steel throat ring is hauled 40 miles by highway on 16-wheel low-bed trailer. Huge 14-ft-wide ring—transferred from plant of Lukens Steel Co. at Coatesville, Pa., through Downingtown, to Sun Shipbuilding Co. yards at Chester, Pa., for heat treatment—will form frame for 45,000-hp propeller-type turbine at Wheeler Dam on northern Alabama's TVA system. Turbine is under construction at Baldwin Locomotive Works, Eddystone, Pa. Transportation of ring, dubbed "Operation Monster," proceeded over specially selected route, under state highway department permit after careful check of all bridge capacities and clearances. Autocar tractor, with 164-in. wheelbase, and Rogers semi-trailer handled unusual hauling assignment.

Comprehensive Parkway System Provides Essential Traffic Arteries for Long Island

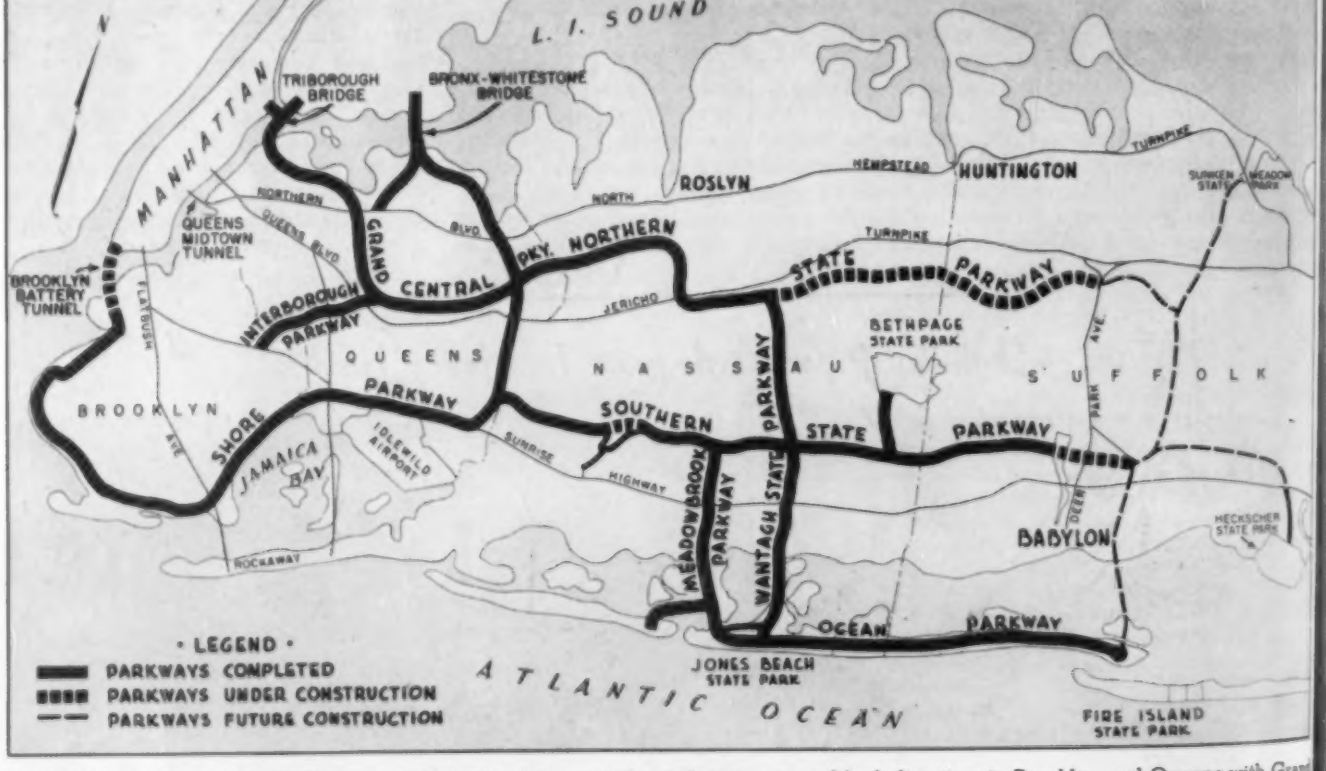
System Has Record of 2.5 Fatalities per 100 Million Vehicle Miles as Against National Average of 11.5

SIDNEY M. SHAPIRO, M. ASCE
Deputy Chief Engineer, Long Island State Park Commission

TWENTY-TWO YEARS AGO the need for arteries of travel free of congestion had become one of the most pressing factors in the orderly development of the entire New York metropolitan area. Travel into the city from Long Island was hopelessly throttled. To have further delayed the establishment of an arterial network would have been a major civic blunder. The program was finally launched and a pattern was established for an unparalleled arterial system made possible by the cooperation of federal, state, city, county and other authorities who have provided the leadership as well as the necessary lands and funds.

With the exception of 20 miles now under construction at the easterly extremities of the system, this entire comprehensive network is in use in the Counties of Kings, Queens, Nas-

CONTRAST OF UNCOLORED CONCRETE in decelerating lanes and curbs with dark pavement provides added safety to traffic on Northern State Parkway, Nassau County, Long Island. Pavement concrete colored with carbon black blends in with landscape effect and reduces glare for daytime driving. Funnel-shaped entrances to main roadway prevent simultaneous entrance of more than one car.



LONG ISLAND STATE PARKWAY system, 158 miles long, is tied together at west end by belt system in Brooklyn and Queens with Grand Central and Interborough Parkways serving as inner spokes. Arterial connections across East River and Long Island Sound are provided by Triborough and Whitestone Bridges, Queens Midtown Tunnel and East River bridges. Brooklyn-Battery Tunnel, now under construction, will form important link in over-all system. Northern and Southern State Parkways are being extended total of 20 miles eastward into Suffolk County. Grading operations are completed, bridge construction is moving rapidly and placing of concrete pavement is under way.

sau and Suffolk, over 20,000,000 cars a year traveling over it at the city end and 9,000,000 a year in Nassau County. The population in these four counties is 4,900,000 persons.

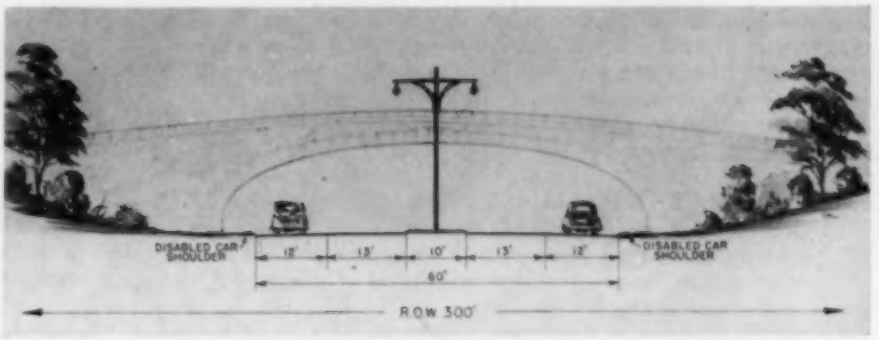
The cost of the system to date, exclusive of land, is $108,000,000. Design and construction were supervised through a coordination of the activities of the Long Island State Park Commission, the State Department of Public Works and the New York City Department of Parks.

Freed of crossings at grade by the construction of 291 stone-faced reinforced concrete bridges, the parkways are of controlled-access design having no abutting access except at entrances and exits at regulated and infrequent intervals. A mantle of zoning protects the right-of-way blocking undesirable development of private property adjacent thereto.

Basic principles of design include 8-in.-thick reinforced concrete pavement colored with carbon black, with outside lanes 12 ft wide and inside or passing lanes 13 ft wide; accelerating and decelerating lanes of uncolored concrete at exits and entrances; funnel-shaped entrances to the main roadway to prevent simultaneous entrance of more than one car, and mountable curbs of white cement. Shoulders 10-ft wide and level, are carved out of the landscaped side slopes to provide a space for disabled cars off the main concrete roadway. This feature is a "must" in all parkway design. Footpaths are also provided to keep pedestrians off the traveled roadway, particularly through built-up communities, with benches placed at suitable intervals. Improved lighting is also a requisite.

These items of engineering design combine to provide a complete and satisfactory artery from the point of view of traffic engineering and safety, with a record of 2.5 fatalities per hundred million vehicle miles as against a national average of 11.5.

One of the most important economic benefits of the parkway system is in the enhancement of property values adjacent to the parkway. It is a well-known fact that the increase in taxable values in Westchester County and on Long Island following the establishment of the parkway sys-



GRADE SEPARATION STRUCTURES eliminate all crossroad intersections at grade, in some cases combining two adjacent crossroads over single structure. Interchanges are confined to bridges at intersections of relatively important arteries. Illustration shows typical cross section of modern design used on Long Island State Parkway system. Features include divided pavement, white mountable curbs along darkened concrete pavement, level shoulders for disabled cars, grade-separated crossings, accelerating and decelerating lanes at entrances and exits, single-lane entrances, highway lighting and pedestrian paths.

STONE-FACED REINFORCED CONCRETE BRIDGE on Northern State Parkway Extension in Nassau County is one of 24 such structures now being built. Long Island Parkway System has 291 bridges of similar design.

ONES BEACH STATE PARK, major objective tapped by Long Island State Parkway System, is reached by two causeways from mainland. Placing of 40,000,000 cu yd of hydraulic fill in reclamation of original isolated barrier reef makes resort available to over 4,000,000 people annually. Parking facilities accommodate 15,000 cars. Fairchild Aerial Surveys, Inc., photo.

tem was enormous. A well-planned parkway is a great asset to the community not only from a traffic viewpoint but also from civic, health and esthetic viewpoints. People are attracted to the community because of the parkway facility and are encouraged to put up better homes.

In this connection, assurance that the parkway will always serve as a landscaped artery for non-commercial traffic maintaining the high value of the residential area it traverses, is provided by state law which includes in the appropriation acts the stipulation that "All such parkways, excepting such service roads, shall be maintained as parkways restricted to pleasure vehicles and without access except at designated points. Parkway service roads shall be open to mixed traffic." This makes it impossible to change the character of the parkway by local law to permit usage by commercial vehicles.

Private property adjoining the parkway right-of-way in practically all cases is zoned for residential purposes. Business frontage is limited principally to adjacent corners and cross-roads and streets. The Park Commission has advocated a high level of zoning for the strip immediately adjacent to the state right-of-way.

Most towns in Nassau and Suffolk Counties have adopted residential zoning for areas within 1,000 ft of the parkway right-of-way and requests for variances or changes of zoning in these areas are vigorously opposed by the Commission. Billboards and advertising signs are prohibited along the parkway system. No signs within 500 ft of the right-of-way outside the city limits or within 200 ft inside the city limits can be erected without approval of the park authorities.

Together, the entire unified network provides an arterial system on Long Island serving the suburban communities, parks and beaches, carrying heavy loads of traffic in and out of the city with reasonable speed, safety and comfort on an attractive right-of-way, all forming a comprehensive park and parkway system for the use of the people of the metropolitan area.

Abstracted from paper presented at Thirty-Third Annual Meeting of the American Association of State Highway Officials.

Reflector-Type Lane Dividers Effectively Channelize Highway Traffic

CORRUGATED WHITE CONCRETE TRAFFIC MARKERS and reflector curbs are effective means of channelizing traffic on heavily-traveled six-lane highway in Passaic County, N.J. Highly visible day and night, wet or dry, corrugated separators have additional safety feature of providing audible warning to drivers who tend to veer into adjoining lanes. Construction of marker consists of placing regular gray concrete in 2-ft-wide space between lanes for full depth of slab except for top 1 in. which is filled with white concrete. Corrugations are made with hand scoring tool while concrete is still plastic. Lane divider is flush with surface of adjoining lanes. This new contribution to highway safety is largely result of continuous research and testing by the New Jersey State Highway Department. Photos courtesy Universal Atlas Cement Co., N.Y.

Engineers' Notebook

Angle Trisected by Graphical Methods

JAMES B. GOODWIN, M. ASCE
Toronto, Canada

ALTHOUGH FOR MANY YEARS scientists and mathematicians have tried without success to solve the problem of trisecting an angle, and despite the fact that it has been proved mathematically that the angle cannot be trisected, two methods that present near perfect solutions are outlined here. Trisection of angles by either method gives a degree of accuracy equal to that of any other graphical solutions that depend upon the skillful use of drafting tools.

First Method

In Fig. 1 the angle α is to be trisected: With center A and radius 3 describe arc BC. Extend radius to a value of 4, to D. Draw DE parallel to AC. With center D and a radius of 4, draw arc BE. Divide arc BE into four equal parts by bisections. It is evident that $^3/_4$ of arc BE is equal to the total arc BC with radius 3, and too, that $^1/_4$ of arc BE is equal to the arc for $^1/_3\ \alpha$ with radius 3.

Divide $^3/_4$ of arc BE and the arc BC into, say, eight equal parts. Choose the two divisions next to the $^1/_3$ point, viz. $^2/_8$ and $^3/_8$ of arc BE, one on either side. Rotate the arc AC to position at $^2/_8$ or $^1/_4$. Lay off $^1/_{16}\ \alpha$ below AB and draw $A_x x$ parallel to it. Since the net change of angle for radius AB to $A_x x$ is the difference between the change of the larger arc and the angle rotated by the inner arc, $^1/_4\alpha - (^1/_4 \times {}^3/_4\alpha) = {}^1/_{16}\alpha$. The radius $A_x x$ intersects the arc at x, which is a point on a hypocycloid.

Establish point y from position at $^1/_8$. Join x and y. These points may be checked by pointing off from the arc BC, as the ends of the arc are known. With arc at position P, the arc would intersect the line xy at z and thus establish the arc Pz for $^1/_3\ \alpha$. Of course, the points x and y are on a curve but since the arc Pz intersects at about $^2/_3 \pm$ of the distance from x to y, the difference between a straight line and curve is hardly discernible by drafting, particularly so since the hypocycloid is a very flat curve at these points.

The difference between the actual and theoretical may be given as $\delta\alpha$, which is as near to zero as may be! It may also be stated that if the arc ($^3/_4\ BE$) and the arc for α be divided into, say, 16 or 32 points, the accuracy becomes almost perfect although perhaps difficult to show by drafting. By pointing off the arc Pz to BP_1, it becomes the arc for $^1/_3\ \alpha$ in its original position.

Second Method

The second method of trisecting an angle is based on the use of arcs with constant chord and varying radii.

It is evident that various and equal parts or factors of angles of 45 and 60 deg may be trisected by use of bisections, and an almost infinite number of combinations is possible to produce as many points of trisection to be joined, as in the first method, by infinitesimally short straight lines. This may be illustrated by Table I.

By combining any of these by addition and subtraction it is evident that a sufficient number of angles may be found to fulfill their requirements. Thus $3° 45' + 3° 16' 52^1/_2'' = 7° 1' 52^1/_2''$, which is $^1/_3$ of $21° 5' 37^1/_2''$, and $3° 45' - 3° 16' 52^1/_2'' = 0° 38' 07^1/_2''$, which is $^1/_3$ of $1° 24' 22^1/_2''$, and so on indefinitely. The values of these angles are given in degrees merely to clarify the process, all of which, however, may be accomplished by compass and ruler without giving angles in degrees.

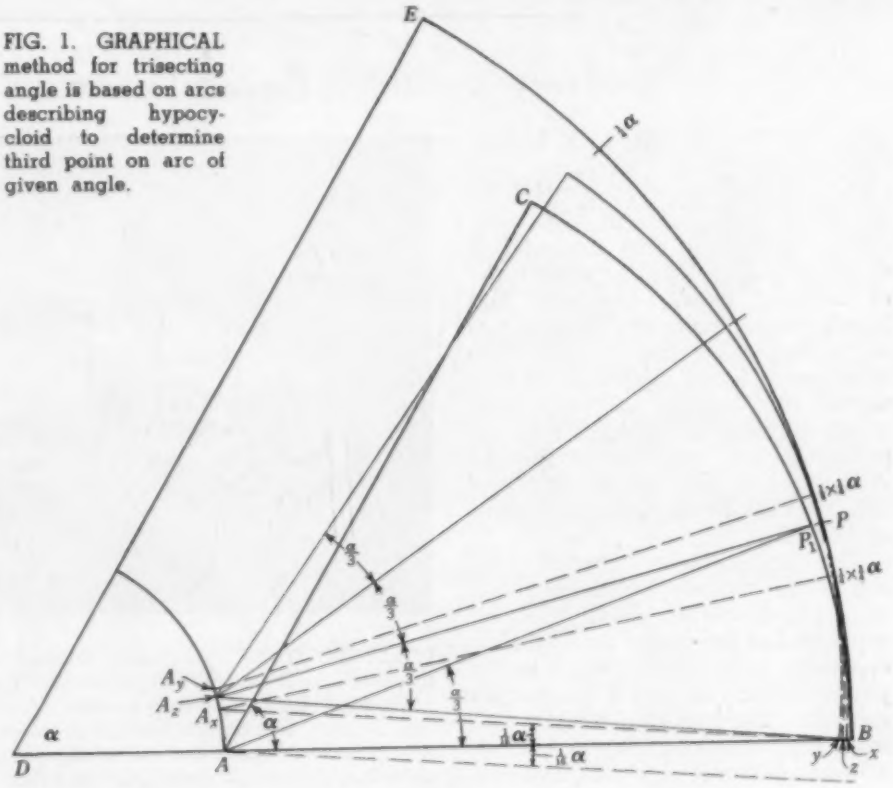


FIG. 1. GRAPHICAL method for trisecting angle is based on arcs describing hypocycloid to determine third point on arc of given angle.

TABLE I. FACTORS OF 45- AND 60-DEG ANGLES

180°	= 3 × 60°	157° 30′	= 3 × 52° 30′ and 52° 30′ = 45° + 7° 30′
90°	= 3 × 30°	78° 45′	= 3 × 26° 15′
45°	= 3 × 15°	39° 22′ 30″	= 3 × 13° 07′ 30″
22° 30′	= 3 × 7° 30′	19° 41′ 15″	= 3 × 6° 33′ 45″
11° 15′	= 3 × 3° 45′	9° 50′ 37½″	= 3 × 3° 16′ 52½″
135°	= 3 × 45°	112° 30′	= 3 × 37° 30′
67° 30′	= 3 × 22° 30′	56° 15′	= 3 × 18° 45′
33° 45′	= 3 × 11° 15′	28° 07′ 30″	= 3 × 9° 22′ 30″
16° 52′ 30″	= 3 × 5° 37′ 30″	14° 03′ 45″	= 3 × 4° 41′ 15″
8° 26′ 15″	= 3 × 2° 48′ 45″	7° 01′ 52½″	= 3 × 2° 20′ 37½″

In Fig. 2 the third points of arcs with the common chord AB are shown for angles differing by 22° 30′, and the third points of these angles are joined by a flat curve. For practical use no other intermediate angles are necessary although theoretically available.

Where the angle to be trisected is small such as, say, 5 deg as shown in the sketch, the center for the arc with the chord AB would be too distant, so 90 deg is added to the angle to be trisected. After trisecting the small angle plus 90 deg, lay off 30 deg and the balance is the third part of 5 deg. This is shown in the sketch by dotted lines.

The actual value of the small angle is given in degrees which, however, is not permitted by the method of Euclid, but it is done to differentiate the process relative to the other angle in the sketch and to more clearly visualize the method. The angle could as well be called α, β, or any unknown value.

To determine the center for the arc for 90° + α or β, it is only necessary to start with a point on the horizontal axis, say, well to the left, to avoid confusion and lay off $\frac{1}{2}\alpha$ above this line. Add to this 45 deg or $\frac{1}{2}$ of 90 deg.

Through B draw a radius parallel to this line and it will intersect the horizontal axis at the center for this arc, and the arc cuts the angle at the third point at the intersection of the controlling line for all trisections.

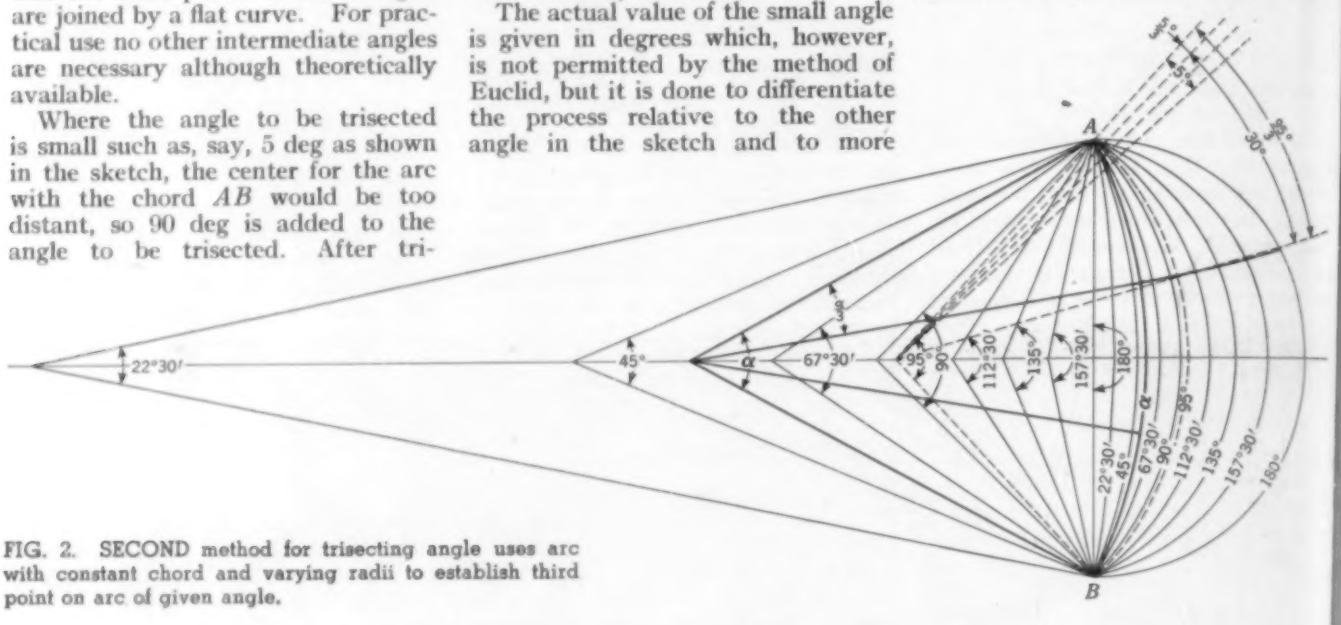


FIG. 2. SECOND method for trisecting angle uses arc with constant chord and varying radii to establish third point on arc of given angle.

Navy Constructs Precast Concrete Bungalows

SINGLE-STORY DUPLEX bungalows of thin precast reinforced concrete panels are being constructed by the Naval authorities at Guam for familes of enlisted men stationed at that base. Developed for other types of building during the war, and found cheaper, more efficient and saving in lumber, precast concrete construction is found adaptable to personnel buildings at advance bases where shipment of materials is an important factor. Materials are shipped in bulk, and wall panels and roof slabs are cast, finished, surface treated and cured at the site.

The bungalows are designed to resist earth tremors, typhoons, fire, insects and rodents. Roof slabs are supported at the center on a continuous ridge beam resting on a center party wall and an inside and outside column. The roof, which has a wide overhang, is covered by a built-up asbestos felt over rigid insulation.

PRECAST CONCRETE single-story duplex bungalows at Guam Naval base, illustrated here by model, are of modern design specifically developed by Navy Bureau of Yards and Docks for housing island-based Navy families. Center ridge beam of structure rests on party wall and on inner and outer columns. Accommodations consist of living room, dining room, two bedrooms, kitchen and bathroom with concrete floors. Partitions between rooms are of ¾-in. plywood. Screened jalousies extending from floor to ceiling take place of windows.

...THE READERS Write

Outlines Simplified Cost-Keeping Method for Contractors and Builders

TO THE EDITOR: The able discussion by A. O. Babb, Assoc. M. ASCE, in the August 1947 issue, ranks current and adequate cost records as the first tool of management. Much has been written about cost systems for mercantile and manufacturing enterprises with permanent location, persistent personnel and repetitive product. Such enterprises have a comparatively smooth performance and do not demand the current control of day-to-day operations which is so essential in construction. They also admit a degree of refinement and detail which becomes absurd and prohibitive to the contractor. Most accountants, not understanding construction practice, install cost systems which are not immediately responsive and are far too complicated for successful operation. The average contractor and builder needs a cost system which is inexpensive to install and economical to maintain. Let me describe such a system that has been in actual use for many years.

Some 25 years ago the Contractors' Association of Northern California, now a chapter of the Associated General Contractors of America, made a study of classification codes and forms and prepared for its members a small handbook of suggestions for cost-keeping. This early recognition of the need for orderly records preceded the extensive mechanization of construction and the increasing practice of subcontracting to specialists. Now it is desirable to make separate notations of charges arising from these developments. I have found that all charges of whatever kind may be segregated under one of the following five heads: Labor, Materials and Supplies, Equipment Rental, Subcontracts and Sundry Expense, and these heads follow through the three coordinated forms which comprise a cost-keeping system.

The first step in competitive contracting is the preparation of a detailed estimate of cost. This is facilitated by an Estimate Form wherein each operation is broken down into the five groups of charges mentioned. A complete analysis of the job by the estimator implies a tentative procedure for performing the work, a classification of the operations involved, which classification will be followed by the costing staff, and it also affords an appraisal of the financial risk taken in the various steps of performance which should be reflected in the bid. Assurance will be provided by a record of actual costs of previous similar operations under known conditions. There is much evidence that too many jobs are undertaken without a working plan and an adequate cost analysis based on that plan.

The second form is a Daily Cost Distribution. Procedure will be simplified by considering this form as an invoice register wherein every charge, including payroll, is an invoice, classified as to job and operation by a rubber stamp on the document, then entered in the appropriate column. The details of time taking, memoranda invoices for materials taken from company warehouse, and equipment rental charges for company-owned plant may vary, but it is essential that all charges be routed into the office daily for entering and posting by the clerical staff. Job overhead is treated as one of the operations, and general administrative overhead as a separate job.

A third form is a Cost Summary in which are segregated the cumulative charges against each operation under the same five heads. These are posted from the Daily Cost Distribution with suitable columns for progress made and unit costs. Pencil notations of estimated costs appear at the top of the columns, and serious deviation indicates the need of a conference between estimator and superintendent. At the conclusion of the job these data become an invaluable guide to the estimator and management for future bidding. This form is actually a subsidiary ledger, and consolidation of the segregated figures may be carried as far as desired before posting to the control account in the general ledger.

It has been stated that in the ordinary accounting system bookkeeping and cost-keeping are two distinct and separate procedures "and never the twain shall meet." But in such a system—or lack of system—there is no check on distributed costs and immediately they are suspected as incomplete or erroneous. In the system described, it is apparent that all charges go through the cost records to appear finally as debits under Jobs in Progress in the ledger, while the corresponding credits go directly into the ledger. Thus a trial balance checks the completeness and accuracy of the cost-keeping as well as the bookkeeping. Furthermore, simplicity and economy are achieved by the absence of duplication of entries.

An eminent engineer has defined our profession as "the science of making a dollar earn the most interest." This will never rank with the more classical definitions but it does direct attention to the business aspect of engineering and the important place of management in technical enterprises. Again I wish to say that current and adequate cost records are the first tool of construction management.

ARTHUR J. GRIER, M. ASCE
Oakland, Calif.

Newspapermen Thank ASCE for Public Relations Help

Receipt of the letter quoted below was a unique experience, perhaps not often enjoyed by engineer society secretaries. The generous newspaper space and publicity afforded the Society and individual members during the past two years indicate the value of a competent public relations contact. The following letter from two newspaper reporters provides further indication of that fact. W.N.C.

DEAR COLONEL CAREY: It was the pleasant experience of the undersigned to have drawn assignments from our respective papers to cover the 1947 Fall Meeting of the American Society of Civil Engineers now in session in our city.

Conventions and meetings, as a rule, present to the average reporter its usual problems, headaches and a lot of leg work.

Your meeting, however, is a rare exception. This we discovered when we met Mr. Allen Wagner and found much to our surprise he had everything in readiness for us. So much groundwork has been done by Mr. Wagner that we now find it a genuine pleasure to cover a national meeting.

Only last week we handled another national convention here and almost "took to drink" in our desperation to keep abreast of the proceedings.

We only met Mr. Wagner this week, and he has no knowledge of this letter. It is spontaneous on our part as we could not resist the opportunity to hand deserved credit where it is due. It is just another verification of the saying that "it takes a newspaperman to get along with the working press."

DOUGLAS R. ELLER
Reporter, Florida-Times-Union
JAMES F. MASSEY
Reporter, Jacksonville Journal
Jacksonville, Fla.

Eccentric Wall Footing Presents Another Paradox

DEAR SIR: The article, "Scientific Approach Reveals Fallacies in Paradoxical Engineering," by Prof. S. F. Borg, in the July 1947 issue, presented several examples which seem "to further the claim that a part of a structure may be stronger than the whole structure." To Professor Borg's list there may well be added a paradoxical construction of frequent occurrence in building practice—the offset wall footing.

This type of construction, use of which is commonly dictated by property limits, is illustrated in Fig. 1, which shows three similar bearing walls, carrying equal loads, but supported by footings of different widths. For convenience, the weights of the footings are assumed to be included in the wall loads.

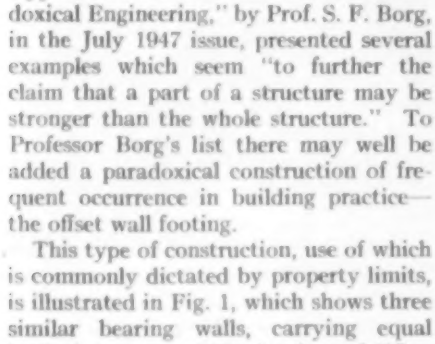


FIG. 1. THREE SIMILAR BEARING WALLS supported by footings of different widths show that bearing condition is theoretically worsened by increase in footing width.

The soil pressure diagrams, based on the customary assumption of straight-line pressure variation, reveal that an increase in the footing width does not decrease the maximum soil pressure but on the contrary *increases* it! That is, widening the footing worsens the bearing condition—at least theoretically. "A paradox, a paradox, a most ingenious paradox," to quote Gilbert and Sullivan.

This peculiar situation has long been recognized. The late Daniel E. Moran, M. ASCE, has this to say in Kidder-Parker's *Architects' and Builders' Handbook:* "While theoretically faulty, if not useless, it is indisputable that offset footings have generally served the purpose for which they were designed." Another instance of prim, beautiful theory clashing with rude, crude facts?

A possible explanation of the apparent contradiction between theory and experience may be as follows. If the maximum pressure under an offset footing becomes excessive, minor, local yielding of the soil may take place, accompanied by a slight tipping of the footing—e.g., counterclockwise for the footing of Fig. 1 (*b*) or (*c*). The wall load will then be delivered to the footing closer to the inside face of the wall, with consequent reduction in the maximum soil pressure.

Since the rotation of the footing can cause the wall to deliver its load almost at its inside face (possibly with some local crushing of the masonry at that location), it is evident that a considerable advantage in soil bearing conditions can result from the use of the theoretically useless or worse than useless footing projection. Unfortunately, at the same time, the wall is put into flexure by the now eccentric reaction at its bottom. A preferable solution for the eccentric wall footing problem lies in the use of reinforced concrete, as indicated in Fig. 2.

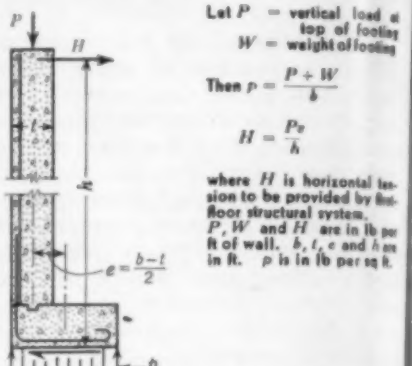


FIG. 2. USE OF REINFORCED concrete overcomes objection to eccentric footing illustrated in Fig. 1.

VICTOR R. BERGMAN, Assoc. M. ASCE

New York, N.Y.

Engineers and Architects Asked to Work Together

DEAR SIR: The recent legal action of the Province of Quebec Association of Architects to restrict the activities of engineers in building design and construction is of particular interest at this time when the professional approach of trained technicians to their work is frequently maintained with difficulty in the face of increasingly strong pressure of the union movement to absorb technical activities.

Such friction between the architectural and engineering professions can only result in a loss of prestige to one or both.

Fortunately, between competent and discerning practitioners of both professions there exists—and should exist—a mutual respect for their individual abilities, based on the realization that no important building project has been, or can be, an outstanding success without the respective training, experience, and skill of engineers and architects coordinated toward a common result.

The chief function of the architect is to solve a particular problem of building construction in such a way as to achieve a structure or structures with the proper and harmonious balance of utility, strength, beauty, and economy. The beauty achieved by the competent architect is not only evident in the mass proportions, refinement of detail, color, and texture of a structure, but is also inherent in the basic symmetry and efficiency of the component parts of the plan, whether it be for skyscraper, dwelling, memorial, or factory; and if the project is of any magnitude, the conception takes material form through the skill of the engineer.

In such a project, the engineer must depend on the planning skill of the architect, the architect on the construction skill of the engineer. The item of utility commands the skill of the mechanical, the electrical, (and in the industrial field, the chemical) engineer; the item of strength, the structural engineer. Economy demands the attention of all.

It is a tribute to the modesty of the engineering profession that the structures which have made the creative conceptions of celebrated architects possible, and which have made their reputations secure, have been designed structurally, mechanically and electrically, by engineers who are anonymous, or generally unknown to the lay public. Yet the engineers, who have made magnificent skyscrapers a characteristic symbol of American ingenuity, might never have attempted such projects if not spurred on by the expansive imagination of the architect.

There are codes of professional ethics. There are license laws for engineers and architects, designed for the protection of the public in matters of safety, health, sanitation, and aesthetics. There should be no facts at issue between the professions. If either the practicing engineer or architect feels impelled to invade the field of the other, let him meet the legal requirements, and qualify for license in the field he desires to enter. If this course is followed, engineers and architects can cultivate the mutual respect of trained specialists for each other, a respect which will develop the harmony and solidarity of basic professions and establish them more firmly in the minds of a public at present confused with the high cost of building construction, and bewildered by the built-up, press-agented importance of such vocations as crooners, band leaders and movie stars.

ERIC FLEMING, M. ASCE

New Brunswick, N.J.

"Rod Waving" of Interest to Engineers of 1870's

TO THE EDITOR: Recent issues of CIVIL ENGINEERING have carried contributions in regard to "rod waving." Engineers may, therefore, be interested in the attached clipping from *The Railroad Gazette*, of May 2, 1874, in which the same subject is rather fully discussed.

C. S. LEET, Assoc. M. ASCE
Pittsburgh, Pa.

Editor's Note: That engineers are faced with similar problems over a long period of time has been called to our attention by other discussers. A case in point was the protracted discussion of vertical curves. But the deluge of discussions received in some of these elementary problems indicates the need for airing them periodically.

Each new generation of engineers seems to feel that it has new and better solutions to old problems. This is a healthy situation because once in awhile an ingenious suggestion helps many engineers solve a simple but time-consuming problem that has bothered them for years. However many older engineers recall published articles and textbooks that give better solutions to the many recurring problems faced by today's engineers than are provided in our current literature. A few excerpts from Mr. Leet's clipping from an 1874 issue of "The Railroad Gazette" are reprinted here to show that such discussions have changed little in 73 years.

"Of late I have noticed several articles in your paper treating on the methods of avoiding and 'Eliminating the Error in Leveling, from want of Perpendicularity of the Rod.' I have had some experience in leveling, and have tried 'swaying or waving' a rod, as mentioned by some of your correspondents, for the purpose of obtaining the 'shortest rod,' thinking that to be the one required. If the point of support of the rod was in the same vertical plane as the face of the target, then would this be a proper method of obtaining the true reading, and the reading thus obtained would be the 'shortest rod'; but as on some rods the face of the target is from 1 in. to 1¾ in. from the centre line of the rod, it can be easily demonstrated that a reading obtained in this way would be the 'shortest rod,' and that it would be less than the true distance between the planes."

"Whether the reading be great or small is of no consequence, provided that the rod be perpendicular when the sight is taken. The rodman can plumb the rod roughly by balancing it, after it is clamped, so that it shall stand alone for a moment while the leveler sights to the target and sees if it is right; and he will generally find that a rod plumbed in this way will give correct readings, provided that there be no wind and care be taken to balance the rod on the centre of its foot. But for careful and accurate work the rod should be made truly vertical by some means certain of accuracy in all cases. None of the methods described by our correspondents would answer with a Y-level, because the leveler would be able to plumb his rod only in one direction, and would have no means of knowing whether the rod leaned to the right or to the left. Now to plumb a rod accurately and conveniently take two heavy 30° triangles, nail them together at their longest edges with their shortest edges at right angles to each other; then upon these two shortest edges fix two small spirit levels. Fasten a strap to this contrivance and let the rodman sling it over his shoulder; apply it to the edge of the rod, and the rod may be plumbed easily and without loss of time. In principle this is nothing new."

Theories of Temperature Stresses Are Reviewed

DEAR SIR: The review of my book, *Natural Philosophy of Physics, Chemistry and Engineering*, in the November issue, does not bring up the general error of engineering textbooks in calculating temperature stresses in restrained steel structures twice their actual magnitude.

I think this would be covered better and more interestingly by a review of the old and new ideas of expansion.

When iron commenced to replace timber bridges (Burr trusses and town lattice-covered bridges), early iron viaducts embodied wooden struts to brace columns longitudinally because these early designers feared the expansion of iron struts might wreck the column.

Sixty years ago when L. S. Buffington (the writer's old associate) proposed a 28-story skyscraper office building, the editor of the New York *Sun* said it was probably the project of a crank, while the *Architectural News of New York*, in an editorial, said that apparently L. S. Buffington did not know of the expansion of iron. Iron was all right in its place, but not for framing high buildings, because the expansion of the iron frame would soon crack all the plaster and the building would be only a shell. Buffington patented his iron skeleton building with its shelf girders to carry curtain walls, as now embodied everywhere in tall buildings.

Fifty-odd years ago the Pottsville Iron and Steel Co. fabricated a round house for a Southern railroad, which was designed by the late C. Shaler Smith, M. ASCE. Smith had provided two or three hundred expansion joints with slotted holes for the roof frame, which today would be riveted up solid, ensuring greater strength and stiffness under wind pressure.

In the design of the Eads Bridge, temperature stresses were computed, as they are generally today, double the actual amount, as proved by the development of intermolecular forces in my *Thermo-Elastic Studies of Natural Philosophy*.

Metal bars under longitudinal stress expand more laterally than they do longitudinally, which renders the effect of the temperature change less than half it would be if the effect were the same in each direction. The notion that expansion takes place the same laterally and longitudinally, regardless of internal stress and condition, is an error of long standing.

Kelvin discovered that when a weight was suspended by an elastic band and a hot poker was brought near the band, the band contracted lengthwise and drew the weight up. From this phenomenon, he supposed he had discovered in the rubber a material that would contract under heat, notwithstanding the fact that the cubic expansion of the band was tens of thousands of times that of a wire supporting the weight when heated.

C. A. P. TURNER, M. ASCE
Columbus, Ohio

Suggests Painting Pavement Edge as Safety Device

DEAR SIR: Request for publication of this letter in CIVIL ENGINEERING is made in the hope of helping to save human lives. The increase in automobile speed has brought with it the blinding head lights that make night driving hazardous.

It is the writer's opinion that in driving at night the motorist is guided by: (1) highways signs, (2) painted center lines, (3) edge of pavement, (4) tail lights of traffic going in the same direction, and (5) head lights of traffic going in the opposite direction.

When blinding head lights appear, many drivers cannot see the other aids to night driving listed and thus have no guide. As everyone knows, it is dangerous to look directly at oncoming bright lights, and it also becomes dangerous to watch the center line. Thus the driver must keep his eyes to his right and be guided by the edge of the pavement, which in most states is not distinctly marked.

It is my suggestion that the edges of pavements be painted like the center lines. That would enable a driver, sitting on the left side of his car, to keep his eyes to the right on the painted pavement edge and away from the lights.

I pass this suggestion on to highway engineers or college professors of civil engineering who have the facilities for making a few mile test sections and determining the public's reaction to the scheme.

HERBERT L. PRANGE, Assoc. M. ASCE
Caruthersville, Mo.

SOCIETY NEWS

Society Prizes and Medals to Be Awarded

Ten Members Will Be Honored at Annual Meeting for Outstanding Papers

PRIZES AND MEDALS for outstanding contributions to ASCE publications will be presented by the Society at the opening session of its Annual Meeting in New York City, January 21, 1948. Oldest and most distinguished of these awards is the Norman Medal, established in 1872 by the late George H. Norman, M. ASCE, for an original paper considered an especially notable contribution to the profession. The award considered next in importance is the J. James R. Croes Medal, which was established in 1912 and named for the first recipient of the Norman Medal.

In 1884 the late Thomas Fitch Rowland, Hon. M. ASCE, endowed the prize bearing his name for a paper best describing in detail some accomplished work of construction. For the paper considered next in merit to that awarded the Thomas Fitch Rowland Prize, the Society in 1912 established the James Laurie Prize, which was named in honor of the first ASCE President.

The late Francis Collingwood, M. ASCE, established the Collingwood Prize for Juniors in 1894 on his retirement as Secretary of the Society. Papers eligible for this award must describe an engineering work or important investigation with which the author has been connected. Another governing factor in the selection of papers receiving this prize is excellence of style.

In a somewhat different category are the Division prizes, which also will be presented at the Annual Meeting. Oldest of these Division awards is the Rudolph Hering Medal, which was endowed in 1924 by the Sanitary Engineering Division of the Society, for the paper adjudged the most valuable contribution to the sanitary branch of the profession.

The Karl Emil Hilgard Prize in Hydraulics was instituted in 1939 as a result of an endowment left to the Society for the purpose by the late Karl Emil Hilgard, M. ASCE, of Zurich, Switzerland. This prize, consisting of a cash award of $50, is given biennially, and its administration is under the Hydraulics Division of the Society.

Established in 1943, the J. C. Stevens Award goes annually to the author of the best discussion of a paper in the field of hydraulics published in TRANSACTIONS. This award, which is also made on the recommendation of the ASCE Hydraulics Division, consists of books costing not more than $50, to be selected by the recipient.

BORIS A. BAKHMETEFF

BORIS A. BAKHMETEFF, co-winner of the Norman Medal, is an authority in the field of hydraulics. Dr. Bakhmeteff, Honorary Member of the Society and professor of civil engineering at Columbia University, has twice before been the recipient of Society prizes—the James Laurie Prize in 1937 and the J. C. Stevens Award in 1944.

Born in Tiflis, Russia, Dr. Bakhmeteff graduated from the Institute of Engineers of Ways and Communications in St. Petersburg in 1903, with the C.E. degree, and spent the following year at the Zurich Polytechnic Institute. In 1911 he received the doctor of engineering degree from the St. Petersburg Polytechnic Institute, where he served as professor of general and advanced hydraulics and water power engineering from 1905 to 1917. Coincidentally for part of this period (1907 to 1915) he maintained a consulting practice in St. Petersburg.

During the first World War, Dr. Bakhmeteff served with the Red Cross and was chief plenipotentiary of the Central War Industrial Committee to the United States and a member of the Anglo-Russian Purchasing Commission. Representing the Provisional (Kerensky) Government in the United States in 1917, he continued as ambassador of Russia until 1922. In 1923 he set up a consulting practice in New York City, which he still maintains. Since 1931 he has been professor of civil engineering at Columbia University.

Widely known as an authority in the field of fluid flow, Dr. Bakhmeteff has pioneered in the study of open-channel and varied flow, and of flow in granular media, in his laboratory at Columbia. His books include *Lectures on Hydraulics* (1912), *Varied Flow of Liquids* (1914), *Hydraulics of Open Channels* (1932), and *Mechanics of Turbulence* (1936). The latter work, which has been published in France in translation, recently won for Dr. Bakhmeteff the Grande Medaille de l'Association des Docteurs Ingenieurs de France. For his outstanding contributions in the field of hydraulics, the French government awarded him the academic degree of Officer of the Academy and Public Instruction. The paper, "The Mechanism of Energy Loss in Fluid Friction," which has been awarded the Norman Medal, was translated and published by the French government in one of its aeronautical series.

Dr. Bakhmeteff is a member of the Board of Consultants of the Panama Canal, appointed by the Governor of the Panama Canal Zone.

A member of the Society since 1917, Dr. Bakhmeteff was elected Honorary Member in 1945. He has served on the executive committee of the ASCE Hydraulics Division, and until lately as chairman of the Division's Committee on Hydraulic Research. Chairman of the ASCE Committee on Research, he represents the Society on the board of the Engineering Foundation and on the World Engineering Committee, and is a director of the Research Corp. He is ASCE representative on the council of the American Association for the Advancement of Science.

Other organizations in which Dr. Bakhmeteff holds membership include the American Society of Mechanical Engineers, the Institute of Aeronautical Sciences, the New York Academy of Sciences, the Connecticut Academy of Arts and Sciences, Tau Beta Pi and Sigma Xi. Interested in Engineers Joint Council activities, Dr. Bakhmeteff served as chairman of a special EJC panel on legislation for a National Science Foundation.

WILLIAM ALLAN

WILLIAM ALLAN, co-recipient of the Norman Medal, is professor of civil engineering and dean of the School of Technology of the City College of New York. Professor Allan was educated at the Polytechnic Institute of Brooklyn, graduating in 1924 with the degree of civil engineer, cum laude. Eight years later

BORIS A. BAKHMETEFF

WILLIAM ALLAN

Norman Medal for Paper, "The Mechanism of Energy Loss in Fluid Friction"

R. F. BLANKS

H. S. MEISSNER

Thomas Fitch Rowland Prize for Paper, "Deterioration of Concrete Dams Due to Alkali-Aggregate Reaction"

THOMAS R. CAMP

J. James R. Croes Medal for Paper, "Sedimentation and the Design of Settling Tanks"

ROSS M. RIEGEL

James Laurie Prize for Paper, "Structural Features of Hydraulic Structures"

F. L. EHASZ

Collingwood Prize for Juniors for Paper, "Structural Skew Plates"

A. L. GENTER

Rudolph Hering Medal for Paper, "Computing Coagulant Requirements in Sludge Conditioning"

MAURICE L. ALBERTSON

The J. C. Stevens Award for his discussion of Paper, "Evaporation from a Free Water Surface"

A. A. KALINSKE

Karl Emil Hilgard Prize for Paper, "Conversion of Kinetic to Potential Energy in Flow Expansions"

after a period of evening study, he received the degree of master of civil engineering from the same school.

Following his graduation, Professor Allan went through the "Loop" course of the Bethlehem Steel Co. at Bethlehem, Pa., and was employed for a year in the Bridge and Fabrication Department. He returned to New York in 1925 to become field engineer and, later, office engineer for Robert E. Carlin. In 1929 he became bridge designer for the New Jersey State Highway Commission in Jersey City, working on stress analysis and design of the river crossings and approach spans of the Pulaski Skyway. During the same period (1929 to 1932), he did graduate work in the evening at the Polytechnic Institute of Brooklyn and taught in both the graduate and undergraduate schools.

Early in 1933 Professor Allan joined the staff of the School of Technology of the City College of New York. Later, as director of the Hydraulics Laboratory, he designed new apparatus and made changes in equipment to modernize and

expand the laboratory. In 1937 he became assistant professor of civil engineering, and since 1940 has been chairman of the department of civil engineering. In 1943 he was made associate professor of civil engineering, and served as acting dean of the School of Technology for the year 1945–1946. On September 1, 1947, he became professor of civil engineering and dean of the School.

During the war, Professor Allan served as chairman of the department of applied mechanics of the Defense Training Institute of the Engineering Colleges of Greater New York. In addition, from 1941 until termination of the program in 1945, he was director of the Engineering, Science and Management War Training Program of the U.S. Office of Education at City College, in which some 13,000 persons were trained.

Professor Allan became associated with his co-author, Dr. Bakhmeteff, in 1933, while doing graduate work at Columbia University. He was an active participant in the Hydraulics Colloquium at Columbia and in seminars on fluid mechanics and applied hydraulics conducted by the New York City Board of Water Supply. He has served as engineering consultant on a number of hydraulics projects. In addition to the paper awarded the Norman Medal, Professor Allan is co-author with Dr. Bakhmeteff of "Energy Balance in Fluid Friction Patterns," presented at the Sixth International Congress of Applied Mechanics in Paris in 1946. He is author of a *Manual for Fluid Mechanics Laboratory*.

Joining the Society as a Junior in 1924, Professor Allan became an Associate Member in 1931 and a Member in 1946. At present he represents the Society on the board of the Engineering Societies Library. Other societies in which he has membership are Tau Beta Pi, Sigma Xi and the American Society for Engineering Education. He is secretary-treasurer of the Middle Atlantic Section of the latter organization.

THOMAS R. CAMP

THOMAS R. CAMP, recipient of the J. James R. Croes Medal, has done considerable research and development work in hydraulics and sanitary engineering, has written extensively in these fields, and is the holder of several patents. His writing has won for him two other Society prizes. In 1941 he was the recipient of the Karl Emil Hilgard Hydraulic Prize for a paper on "Lateral Spillway Channels," and in 1945 of the J. C. Stevens Award for his discussion of the paper, "Effect of Turbulence on Sedimentation."

A native of Texas, Mr. Camp was graduated from the Agricultural and Mechanical College of Texas in 1916. For the next seven years, except for a period of Army service during World War I, he was associated with the late John B. Hawley, M. ASCE, and other Texas engineers in municipal engineering work. From 1923 to 1925 he did postgraduate work at the Massachusetts Institute of Technology, receiving the master's degree in civil engineering in the latter year.

From 1925 to 1928 Mr. Camp was in municipal engineering practice in North Carolina under the firm name of Spoon, Lewis & Camp, and for the following year was principal design engineer for the late Alexander Potter, M. ASCE, in New York City. In 1929 he became associate professor of sanitary engineering at the Massachusetts Institute of Technology, where he remained until 1944.

For the past four years Mr. Camp has had a full-time consulting practice in the field of hydraulic and sanitary engineering with offices in Boston. In January 1947 he organized with his associates—Herman G. Dresser, M. ASCE, and Jack E. McKee, Assoc. M. ASCE—the consulting engineering firm of Camp, Dresser & McKee, of which he is senior partner.

Joining the ASCE in 1921 as a Junior, Mr. Camp became an Associate Member in 1923 and a Member in 1930.

ROBERT F. BLANKS

AUTHOR OF MANY technical papers and of special engineering reports for the U.S. Bureau of Reclamation is Robert F. Blanks, co-recipient of the Thomas Fitch Rowland Prize. Chief of the Research and Geology Division of the Bureau, Mr. Blanks early acquired an interest in research through part-time employment in the Kansas State Materials Testing Laboratory while working his way through Kansas State College, where he graduated in 1924, with the degree of bachelor of science in civil engineering. He received his C.E. degree from the same institution in 1936.

For several years prior to and following his graduation, Mr. Blanks held various administrative positions in Idaho public schools. Later he served with private irrigation companies in Idaho and on the hydraulic investigations of the American Falls Reservoir and Basin for the state of Idaho. In 1928 he was engaged on the Fort Hall Project of the U.S. Indian Service and in 1929 served the Army Corps of Engineers in its comprehensive investigations to determine the resources and possible development of the Columbia River Basin.

Since 1930 Mr. Blanks has been with the Bureau of Reclamation in Denver. His outstanding work there has been the development of the engineering and geological research laboratories from a comparatively minor operation to their present status, foremost among laboratories of the kind in the world. Mr. Blanks was first assigned to the office of the chief engineer of the Bureau on special studies of the Hoover Dam and power plant, and later was placed in charge of cement and concrete investigations for the dam. The investigations required the organization of two large laboratories, the training of personnel, and the standardization of new and unusual equipment, methods and procedures.

Upon completion of the Hoover Dam studies, Mr. Blanks was assigned to the complete field and laboratory investigation of concrete and concrete materials for all Bureau projects. Later reorganization consolidated all the engineering research laboratories of the Bureau under his direction. In addition to materials testing, the work of the laboratories includes general supplemental investigations for the solution of field construction and design problems; testing of hydraulic structures, machinery models, and structural and architectural models; and supervision of the field control and utilization of the various materials of construction.

A member of the ASCE since 1940, Mr. Blanks also belongs to the American Society for Testing Materials, the American Concrete Institute, Sigma Xi, and Sigma Tau. Active in international professional affairs, he has served on subcommittees of the World Power Conference and the International Commission on Large Dams.

HARMON S. MEISSNER

INVESTIGATION OF THE characteristics of concrete and the properties of cements has been the specialty of Harmon S. Meissner, co-winner of the Thomas Fitch Rowland Prize. Mr. Meissner graduated from the University of Utah in 1922 with the degree of B.S. in civil engineering. In 1929 he received the M.S. degree in civil engineering from George Washington University, after a period of evening study.

From 1922 to 1925 Mr. Meissner was with the Southern Pacific Railroad Co., engaged in the strengthening and repair of the Great Salt Lake trestle, and from 1925 to 1930 he was with the Bureau of Valuation of the Interstate Commerce Commission. In the latter position he assisted in the preparation of engineering reports on the cost of reproducing railroad properties, making inventories of their plants and evaluating their depreciation.

The desire to work on Hoover Dam led Mr. Meissner to transfer to the Bureau of Reclamation in 1930. In the chief engineer's office in Denver, he was en-

ployed on the preparation of plans and specifications for this structure, as well as for Madden Dam in the Canal Zone and Cle Elum Dam in the state of Washington. In particular, the design of reinforced concrete structures on these projects occupied his attention.

The unprecedented size of Hoover Dam and the accelerated construction program dictated new design and construction procedures requiring extensive research work. This work involved the development of cement of low heat of hydration, and determination of the thermal properties of mass concrete in order to control temperature rise and subsequent volume changes. In 1931 Mr. Meissner was placed in charge of the Bureau's newly created cement laboratory, which conducted research work on these problems. The paper, for which the Thomas Fitch Rowland Prize is given, discusses what Mr. Meissner considers one of the most pressing studies undertaken by the laboratories of the Bureau—the deleterious reaction between active aggregate and cement. At present Mr. Meissner is research engineer in charge of coordinating the research activities of the Bureau on concrete and cement.

Many of Mr. Meissner's technical writings have appeared in the *Journal of the American Concrete Institute*. He is chairman of Committee 609, Vibration of Concrete, of the Institute, and a member of Committee C-1, on cement, of the American Society for Testing Materials. He also holds membership in Sigma Xi and is an associate of the Highway Research Board. Joining the ASCE as an Associate Member in 1936, he has been a full member since 1944.

ROSS M. RIEGEL

THIS YEAR'S RECIPIENT of the James Laurie Prize is Ross M. Riegel, who has been prominently identified with the TVA since its inception. Mr. Riegel was educated at Cornell University, graduating in 1904 with the degree of civil engineer. Following his graduation, he was employed for several years in the fields of hydraulics and structures—principally as designer for the New York City Board of Water Supply and on the construction of hydroelectric plants in West Virginia.

In 1915 Mr. Riegel joined the staff of the Miami Conservancy District in Ohio, where after several promotions he became designing engineer for dams and appurtenant structures. During the period 1915 to 1926 he made model experiments for the District on the use of the hydraulic jump as a means of dissipating energy and, with S. M. Woodward, Hon. M. ASCE, prepared a report on the subject. During World War I, he was granted leave of absence to work with the U.S. Shipping Board.

From 1921 to 1926 Mr. Riegel served as hydraulic engineer for the West Penn Power Co., of Pittsburgh, engaged in exploration, design and construction on the Cheat River development in West Virginia. He was then appointed to the Pittsburgh Department of Public Works as departmental designing engineer on a large program of public improvements. The program included construction of new pumping stations and other waterworks improvements, several bridges and major street improvements. Upon completion of the work in 1931, Mr. Riegel served for two years as head of the Pittsburgh Bureau of Bridges.

In December 1933 he joined the TVA as the first man employed on its design staff. Later he became head civil engineer in the design department, which is his present position. In 1946 Mr. Riegel was sent to India by the State Department to advise the Indian government on the Damodar Valley Project.

He became a Junior in the Society in 1907, Associate Member in 1911 and Member in 1919.

FRANK L. EHASZ

FRANK L. EHASZ, winner of the Collingwood Prize for Juniors for his paper, "Structural Skew Plates," has been in private practice for the past two years as consultant to several architects and engineers on housing, hospital, commercial, industrial, and airport projects. Prior to this work, he was in the employ of consulting engineers and builders engaged in the design and construction of airports, parkways, viaducts, bridges and structures.

For a year following his graduation from New York University in 1933, with a B.S. in C.E. degree, Dr. Ehasz attended the University of Technical Sciences in Budapest, the recipient of a full fellowship in structural engineering sponsored by the Institute of International Education. He then studied for two years at Lehigh University on a research fellowship in civil engineering. The latter institution subsequently conferred upon him the degrees of M.S. in C.E., Ph.D., and C.E.

Dr. Ehasz was an instructor in civil engineering at Lehigh University for two years and held a similar position in theoretical and applied mechanics at the University of Illinois for three years. At present, in addition to the consulting practice that he maintains in New York City, he is lecturing in architectural construction at the Cooper Union for the Advancement of Science and Art.

Dr. Ehasz joined the ASCE as a Junior in 1933, and became an Associate Member in 1947. His other professional affiliations include membership in the American Concrete Institute, Iota Alpha, Sigma Xi, Pi Mu Epsilon, and Phi Eta. He was one of the founders of the Spartan Athletic Club of New York City, which he has served as president.

ALBERT L. GENTER

ALBERT L. GENTER, an authority on sludge elutriation and mechanical filtration, is recipient of the Rudolph Hering Medal. Mr. Genter was born in Breckenridge, Colo., received his early schooling in Salt Lake City, Utah, and his university training in Germany, graduating from the department of chemistry and metallurgy of the Royal Technical University of Berlin in 1904.

In 1905 Mr. Genter returned to Salt Lake City as structural draftsman in the ore-dressing field, and in 1906 in the same capacity he joined the newly organized General Engineering Co., operating under the direction of the late J. M. Callow. This connection led Mr. Genter into filtration engineering, and he was one of the founders of the Kelly Filter Press Co., which developed labor-saving filtration equipment for the industrial field. Inspired by the many technological uses of filtration and their place in the development of practically all branches of engineering, Mr. Genter found an early and lasting interest in this field.

In 1911 he returned to Europe as representative of his company, making Berlin his headquarters. He was successful in introducing the use of Kelly filters throughout the continent. The outbreak of World War I terminated this work in Europe, and Mr. Genter continued his activities in the United States and Canada. By 1918 he was developing his disk-type continuous filter for the United Filters Corp., successor to the Kelly interests.

From 1920 to 1927 Mr. Genter was again with J. M. Callow and his associates. In 1926 he went to Pittsburgh to work on the problem of the abatement of atmospheric and stream pollution by the steel industry. In particular, he worked on the clarification of water from the huge wet scrubbers that removed iron ore dust from blast furnace gases. As a result of this work, he became affiliated with the Bartlett Hayward Co., of Baltimore, engaged in the manufacture and installation of such scrubbers.

In 1931 Mr. Genter's interest in the relatively new field of dewatering digested sewage sludges in continuous suction filters was aroused by two authorities in sewage treatment—C. E. Keefer and the late John H. Gregory, Members ASCE. In 1932 Mr. Genter severed connection with the Bartlett Hayward Co. to devote

his time to private research in his new field of interest at the Back River sewage treatment works of Baltimore. He discovered and developed the elutriation process, which was first incorporated in the new sewage treatment plants designed by Metcalf & Eddy, Engineers, for the cities of Washington, D.C., and Hartford, Conn. Later Mr. Genter was employed in a consulting capacity in connection with sludge elutriation by Winnipeg, San Francisco, and several other cities.

A Member of the Society since 1941, Mr. Genter has contributed numerous papers to the ASCE PROCEEDINGS and to other technical publications. He is the inventor of several processes and processing devices in various engineering fields, in addition to the elutriation process. In 1944, as nominee of the Maryland-Delaware Water and Sewerage Association, Mr. Genter received the Kenneth Allen Award of the Federation of Sewage Works Associations.

A. A. KALINSKE

AUTHOR OF MORE than 50 technical papers on fluid mechanics and allied subjects, A. A. Kalinske is the recipient of the Karl Emil Hilgard Prize for his paper on "Conversion of Kinetic to Potential Energy in Flow Expansions." A graduate of the University of Wisconsin, class of 1933, Mr. Kalinske specialized in hydraulic and sanitary engineering. He then did graduate work at the university, receiving his M.S. in civil engineering in 1935. He was awarded a research fellowship as instructor in hydraulic and sanitary engineering at the university.

From 1936 to 1945 Mr. Kalinske was on the engineering staff of the University of Iowa, where he was active in the research work of the Iowa Institute of Hydraulic Research. He went through the various teaching grades, becoming associate professor of hydraulics and associate director of the Institute. Mr. Kalinske's work during this period was about equally divided between teaching and research in fluid mechanics. His research work dealt particularly with the application of fluid mechanics to problems of sanitary engineering, sediment movement in rivers, and flow in conduits. He did pioneer work in the field of fluid turbulence, and his prize-winning paper is the result of one phase of this work.

During the summers of 1941 and 1942, Mr. Kalinske was a special consultant for the Navy's David Taylor Model Basin in Washington, D.C. During the war, he supervised several research projects of the National Defense Research Committee at the Iowa Institute of Hydraulic Research.

In 1946, Mr. Kalinske became chief hydraulic engineer for Infilco, Inc., of Chicago, manufacturers of equipment used in water, sewage and waste treatment. His present work is primarily concerned with development and design problems dealing with the movement of various suspended solids in water and their separation therefrom.

An Associate Member of the ASCE since 1939, Mr. Kalinske also holds membership in the American Water Works Association, the American Geophysical Union, Tau Beta Pi, Chi Epsilon, and Sigma Xi. At present he is a deputy member of the Hydrology Panel of the Army and Navy Joint Research and Development Board.

MAURICE L. ALBERTSON

THE J. C. STEVENS AWARD goes to Maurice L. Albertson, associate professor of civil engineering at Colorado Agricultural and Mechanical College. Mr. Albertson graduated from Iowa State College in 1941, with the degree of B.S. in civil engineering, and received an M.S. in hydraulic engineering from the State University of Iowa in 1942.

Upon completion of his graduate work in 1942, Mr. Albertson became junior engineer in the Hydraulic Data Division of the Tennessee Valley Authority at Knoxville, Tenn., making hydrologic studies of the region. The next year he returned to the Iowa Institute of Hydraulic Research at the University of Iowa as research associate, later becoming research engineer. During this period with the Institute (1943 to 1947), Mr. Albertson did fundamental wind-tunnel research for the Office of Scientific Research and Development. He also served as an instructor in the department of mechanics and hydraulics of the university.

Research studies for the Navy, made during this period, included investigations of fog dispersal over airport runways and studies of the turbulence created by screens and baffles. At the close of the war, Mr. Albertson continued graduate study toward a Ph.D. in hydraulic engineering, writing his dissertation on the subject, "Evaporation and the Boundary Layer." It was Mr. Albertson's research during this period that led him to write his prize-winning discussion of the PROCEEDINGS paper, "Evaporation from a Free Water Surface."

Mr. Albertson joined the Colorado A. and M. College faculty in August 1947 as associate professor of civil engineering and associate civil and irrigation engineer for the Colorado Experiment Station at Fort Collins. His present research work includes a cooperative laboratory study of well screens and gravel envelopes in relation to the pumping of sand and eventual caving of the aquifer. Mr. Albertson is also in charge of a general investigation of the head loss and velocity distribution in various types of open and closed flow expansions.

A Junior in the Society since 1941, Mr. Albertson is also a member of the American Society for Engineering Education, the American Geophysical Union, the Kansas Academy of Science, the American Association of University Professors, and Sigma Xi.

Four Are Elevated to Honorary Membership

JOHN BOW CHALLIES

CONSERVATION AND USE of the water resources of Canada has been the dominant interest of John B. Challies during his long career as engineer and utilities executive. At present he is vice-president and executive engineer of the Shawinigan Water & Power Co., Montreal, Canada.

Mr. Challies graduated from the School of Practical Science of the University of Toronto in 1903. Five years later he received the C.E. degree from the same institution. From the time of his graduation until 1924, he occupied positions of increasing importance in the Dominion Government departments at Ottawa. He was successively chief hydraulic engineer in the Department of the Interior; superintendent of water power; director and chief engineer of the Water Power and Reclamation Service; founder and first director of the Dominion Hydrometric Survey; and member of the Dominion Power Board and the Dominion Fuel Board.

For many years Mr. Challies served as engineer adviser to the Department of External Affairs on international waterway matters, and was liaison officer for the department on the Research Council of Canada. He represented the Canadian government at the International Engineering Congress in San Francisco in 1915, and at the World Water Power Conference in London in 1924.

Since 1924, Mr. Challies has been with the Shawinigan Water & Power Co., which he has served as department manager in charge of water resources, assistant general manager, and vice-president. During his connection with the Shawinigan Water & Power Co.

the largest private electric utility in the Dominion, Mr. Challies has been engaged in promoting the best use of water power on the many rivers in which the company is interested.

An authority on administrative, investigatory and international aspects of water resources and power, Mr. Challies received the honorary degree of doctor of engineering from the University of

JOHN B. CHALLIES
New Honorary Member

Toronto in 1938 "for achievement in the conservation and use of the water power resources of Canada." His articles in the water power field have appeared in technical publications in both the United States and Canada.

Of particular importance has been Mr. Challies' work in obtaining more adequate recognition for the professional engineer in Canada. Largely through his efforts the Association of Professional Engineers, Province of Ontario, was formed. He was also one of the founders of the Professional Institute of Civil Service of Canada, in which he holds honorary membership. An early member of the Engineers' Council for Professional Development, he has aided that organization in the formulation of professional standards.

His leadership in all movements for advancing the prestige of the engineering profession and increasing its service to the public was recognized in 1938 by his election as president of the Engineering Institute of Canada. In 1947 Mr. Challies was awarded the Julian C. Smith Medal of the Institute for "achievement in the development of Canada." At present he represents the Institute on the executive committee of the Engineers' Council for Professional Development.

Mr. Challies has been a member of the ASCE for 33 years, having joined as an Associate Member in 1914. He has been a full member since 1920. Other American organizations in which he holds membership are the American Society of Mechanical Engineers and the American Institute of Electrical Engineers.

HARDY CROSS

WIDELY KNOWN AS an engineering educator and as the originator of new methods of structural engineering analysis, Hardy Cross is professor of civil engineering and chairman of the Civil Engineering Department at Yale University.

Valedictorian of his class at the age of 17, Professor Cross graduated from Hampden-Sydney College in 1902, with the B.A. degree. He received the B.S. degree from the same institution in 1903, the degree of B.S. in C.E. from Massachusetts Institute of Technology in 1908, and the M.C.E. degree from Harvard University in 1911. He is also the holder of honorary degrees from Hampden-Sydney College, Lehigh University, and Yale University.

Professor Cross gained his early teaching experience as instructor in English in his final year at Hampden-Sydney and as an instructor in English and mathematics at Norfolk Academy during the next three years. From 1908 to 1910, he was an engineer in the bridge department of the Missouri Pacific Railway. In 1912, following a year of graduate study at Harvard, he became assistant professor of civil engineering at Brown University, where he remained until 1918. After three years in general engineering practice, Professor Cross returned to teaching in 1921 as professor of structural engineering at the University of Illinois. He remained there until 1937, when he became professor of civil engineering and chairman of the civil engineering department at Yale University.

He has served as consultant on many engineering projects, including the correction of the settlement of the Charity Hospital in New Orleans, and was a member of the committee of engineers that prepared a report on the Tacoma Narrows Bridge failure. Professor Cross has made other contributions to the profession while serving on the National Committee on Suspension Bridges of the American Society for Engineering Education and on technical committees of the ASCE, the American Concrete Institute and the American Railway Engineering Association.

Professor Cross is, perhaps, best known as the originator of the moment-distribution method of computing stresses in rigid frames. Originally published in the PROCEEDINGS of the ASCE under the title, "Analysis of Continuous Frames by Distributing Fixed-End Moments," the method (known as "The Hardy Cross Method") is now widely used in design offices and the concepts on which it is based have been influential in many other fields. For this paper, Professor Cross was awarded the Society's Norman Medal in 1934.

His other publications include senior authorship, with N. D. Morgan, M. ASCE, of *Continuous Frames of Reinforced Concrete*, and authorship of numerous technical papers, principally on structural engineering subjects. His paper, entitled "Concerning the Importance of Teaching School," presented at a meeting

HARDY CROSS
New Honorary Member

of the American Society for Engineering Education in 1936, is widely known as an expression of his teaching theories.

For his professional achievements, Professor Cross was awarded the Wason Medal of the American Concrete Institute in 1935 and the Lamme Medal of the American Society for Engineering Education in 1944. The latter organization cited him "for his development of revolutionary methods of analysis in structural engineering and for his application of these methods to the rigorous training of civil engineers. . ."

Joining the ASCE as an Associate Member in 1916, Professor Cross became a full member in 1922. His other affiliations include the American Concrete Institute, the American Railway Engineering Association, the Institute of Consulting Engineers, the American Academy of Arts and Sciences, the American Association for the Advancement of Science, and the American Society for Engineering Education. He is an honorary member of the Connecticut Society of Civil Engineers, a national honorary member of Chi Epsilon, a member of Sigma Xi, Tau Beta Pi, Sigma Tau, Omicron Delta Kappa, and Kappa Alpha.

WILLIAM H. McALPINE

A VETERAN IN THE service of the Army Corps of Engineers, William H. McAlpine has an outstanding record of achievement in the use and control of the rivers of the

nation. Since 1902, when he joined the Corps of Engineers, he has been prominent in its important navigation projects involving the canalization of rivers and, more recently, in its projects for flood control on inland rivers. At present he is Special Assistant in the Office of the Chief of Engineers, Washington, D.C.

WILLIAM H. McALPINE
New Honorary Member

Following his graduation from the Massachusetts Institute of Technology in 1896, Mr. McAlpine spent several years with the Massachusetts State Board of Health and the Metropolitan Water Board of Massachusetts. He then entered the employ of the U.S. Bureau of Navigation, and was assigned to duty aboard the *U.S.S. Ranger* marking and mapping the Bay of Panama and the coast of Lower California. Later he was stationed at the Navy Yard at Portsmouth, N.H.

From 1902 to 1912 Mr. McAlpine served the Corps of Engineers at Cincinnati, Ohio, and Frankfort, Ky., as resident engineer on the construction of Lock No. 10 on the Kentucky River and as engineer in charge of the operation and maintenance of all the navigation structures on that stream.

The years 1912 to 1930 were spent in Louisville, Ky., as principal engineering assistant to the District Engineer and, for the duration of World War I, as District Engineer. During this period, Mr. McAlpine was in direct charge of both design and construction features of the canalization of the Lower Ohio River for navigation. The project involved construction of eleven dams, including a unique structure at Louisville that utilized a steep natural fall in the river for development of hydroelectric power. The size of the river and unusual problems of fluctuation and scour made the project one of the most difficult undertaken by the government to date. Upon completion of the Ohio River project, Mr. McAlpine spent the next three years (1931 to 1934) in St. Louis, where he was in charge of the design and construction of locks and dams on the Upper Mississippi.

In 1934 Mr. McAlpine was called to the Office of the Chief of Engineers in Washington to aid the Corps of Engineers in the construction of flood control dams as part of the government's program of public works. Prior to that time, few such dams had been built in the United States, so Mr. McAlpine was called upon to do considerable pioneer work in various capacities in the Office of the Chief of Engineers. He was at first in charge of engineering, and later became Special Assistant to the Chief of Engineers, which position he now holds.

During Mr. McAlpine's tenure in the Office of the Chief of Engineers he has served on practically every board of consultants on every major dam planned or built by the Corps of Engineers—Fort Peck, Denison, Norfork, Tygart, Garrison, Clark Hill and McNary, to name a few. He has served on boards studying river and navigation developments on the Upper Mississippi, the Mississippi below New Orleans, the Missouri River, the Florida Canal and the St. Lawrence Waterway. At present he is a member of the Board of Consultants for the Tennessee Valley Authority, and of the Board of Consultants of the Panama Canal appointed by the Governor of the Panama Canal Zone in connection with new studies of the Canal authorized by the 79th Congress. Mr. McAlpine's wartime services with the Corps of Engineers won for him the Exceptional Civilian Service Award.

A Member of the Society since 1916, he has been a member and secretary of the ASCE Waterways Division and has contributed to the ASCE PROCEEDINGS. He is co-author of a paper on "Modern Types of Navigable Dams," which was presented at the 16th International Congress on Navigation. Mr. McAlpine is a member of the Society of American Military Engineers, and member and past-president of the Engineers and Architects Club of Louisville, Ky.

KARL TERZAGHI

AN AUTHORITY ON soil mechanics, Karl Terzaghi is eminent in both the teaching and consulting fields. At present he is professor of the practice of civil engineering in the Harvard University Graduate School of Engineering.

Born in Prague, Czechoslovakia, Dr. Terzaghi graduated from the Technische Hochschule at Graz, Austria, in 1904. From 1905 to 1914 he was employed in various capacities, chiefly as superintendent of construction on jobs in Austria, the Balkans, northern Russia, and the western part of the United States. He then served for two years in the air corps of the Austrian Army.

In 1916 Dr. Terzaghi became professor of civil engineering at the Imperial Engineering School at Istanbul, Turkey, remaining until 1918 when he accepted a similar position at Robert College (an American institution) in Istanbul. He was at Robert College until 1925, engaging in extensive experimental research on

KARL TERZAGHI
New Honorary Member

foundations, the results of which were published in 1925 in a book entitled *Erdbaumechanik*. From 1925 to 1929 he continued his teaching activities at the Massachusetts Institute of Technology, serving also during this period as a consultant on various dam, foundation and subway projects.

Dr. Terzaghi accepted a professorship at the Technische Hochschule in Vienna in 1929 and remained there until 1938. During these years he was a consultant on Swir III, a hydroelectric power development, in northern Russia; on irrigation projects in Central Asia and Transcaucasia; on the construction of rockfill dams in Algiers; and on numerous other projects in the Eastern hemisphere.

Harvard University invited Dr. Terzaghi to lecture on soil mechanics in 1936, the year of its tercentenary celebration. The First International Conference on Soil Mechanics met at Harvard in that year, and Dr. Terzaghi served as its president. Resigning his professorship in Vienna in 1938, he returned to the United States and was appointed lecturer in the Harvard Graduate School of Engineering.

From 1938 to 1941 Dr. Terzaghi acted as consultant on soil mechanics in connection with the building of the Chicago subway. In 1941 he was employed by the Dravo Corp., of Pittsburgh, on the construction of two drydocks at Newport News, Va. During the past few years he has served as consultant on numerous construction jobs in the United States, Mexico, Canada, and Sweden. Last

year he went to India as a member of a board of consultants for a large reclamation project, and of recent months he has been serving in a consulting capacity in Brazil. For the past year Dr. Terzaghi has filled one of the newly established chairs of professor of the practice of civil engineering in the Harvard Graduate School of Engineering, and he is also lecturer and research consultant in civil engineering at the University of Illinois.

Dr. Terzaghi is the author of *Theoretical Soil Mechanics* and co-author of books on soil mechanics and of a book on engineering geology. Contributor of numerous papers to the ASCE PROCEEDINGS, he was awarded the Norman Medal of the Society in 1930, 1943, and 1946.

His membership in the ASCE dates back to 1925 when he became an Associate Member. He has been a full member since 1927. Dr. Terzaghi's other technical affiliations include the Institution of Civil Engineers, which he served as James Forrest Lecturer for 1939, and the Boston Society of Civil Engineers. He has won the Desmond FitzGerald Medal and the Herschel Prize of the latter organization and the Frank P. Brown Medal of the Franklin Institute, Philadelphia.

"Transactions" Index Is Included in Society Bills

MEMBERS WHO HAVE standing orders for TRANSACTIONS received with their January bills a charge for both Volume 112 of TRANSACTIONS and for a separate volume, TRANSACTIONS INDEX, which covers all TRANSACTIONS papers for twelve years, Volumes 100 to 112, inclusive. Cost to be billed for the index was set by the Board at $1.00 for paper, $2.00 for cloth and $3.00 for morocco. The last index volume was issued in 1934 and covered the years 1921 to 1934, Volumes 84 to 99.

Members and others who do not have standing orders for TRANSACTIONS may desire the new index. It is a valuable addition to every scientific library, public or private, with or without the TRANSACTIONS volumes themselves.

Orders for separate volumes of TRANSACTIONS, Volume 112, or TRANSACTIONS INDEX, Volumes 100 to 112, will be filled as soon as the books are released by the printer. Members who do not have standing orders for TRANSACTIONS and who desire their names added to the 13,000 now on the standing-order list, can be so registered through letter request to the Executive Secretary. TRANSACTIONS are billed, per copy, at $2.00 for paper, $3.00 for cloth and $4.00 for morocco. When placing orders, members should state the type of cover desired—paper, cloth or morocco.

"Transactions" Serves as Nucleus for the Civil Engineer's Library

Volume 112 to Be Mailed in January

HAROLD T. LARSEN, M. ASCE
Editor of Technical Publications, ASCE

WHAT THE MEDICAL journal is to the doctor and the law review is to the legal counselor, the TRANSACTIONS of the Society is to the professional civil engineer.

The truly professional civil engineer, consciously or unconsciously, looks upon his work as a calling—a profession. His lifetime is given over to an objective practice, born in an ideal and nurtured in an atmosphere of enthusiasm. To such a man, the birth of a new idea for finding stresses in a suspended cable, or for dismantling and moving a stiff-leg derrick is cause for rejoicing similar to the saving of a lost soul in the buoyant heart of a clergyman.

A rare opportunity to test this case arose in the current year when the Society's finances required that members desiring TRANSACTIONS pay a relatively nominal sum for collating and binding it. When the orders for Volume 111 were in, it was found that more than half of the membership had elected to continue their reference sets.

Volume 112 is now on the presses and the first bound copies should be in the mail some time in January. It contains 40 papers, which with contributions of discussers account for a total of 234 writers. In addition, the memoir section contains 104 professional records of deceased members. Among the wide diversity of subjects, collated and carefully indexed, are: Design of hydraulic structures (cavitation, uplift of dams, ice thrust, groundwater, drawdown tests of wells, debris barriers, erosion, relief wells for dams and levees); the theory of structures (safety factors, service record of the Brooklyn Bridge, floor loads in buildings, aluminum girders, plywood I-beams, thermal action, matrix analysis); waterway problems (Mississippi River control, shipways, landslide correction); surveying (triangulation, aerial photography, photogrammetry); engineering economics (engineering costs and budgets); regional planning (location of industries); highway interests (express highways, speed of trucks on grades); and professional (engineering education and the President's address).

ASCE TRANSACTIONS can be made the core of the technical library of every civil engineer from Junior to Honorary Member. Current prices for TRANSACTIONS per volume are:

To ASCE members in all grades:

Paper bound	$2.00
Cloth bound	3.00
Half morocco	4.00

To other subscribers, if ordered at once:

Paper bound	$12.00
Cloth bound	13.00
Half morocco	14.00

The subscriber rates are for Volume 112; for older volumes the charge is $4.00 more except that, in all cases, libraries receive a discount of 50%.

Members who desire the new Volume 112 but do not have a standing order on file should place such order and advise Headquarters immediately and state the style of binding required.

Lima Meeting Recommends Pan American Convention

NEED FOR the organization of a Pan American Association of Engineering Societies with purposes and constitution similar to those of the Federation of South American Engineering Societies (USAI), as well as the possibility of convening a Pan American Engineering Congress were discussed at a recent conference of representatives of the USAI held in Lima, Peru. Engineers Joint Council's Committee on International Relations was represented at the meeting by James S. Thompson, New York, N.Y.

A motion, in accord with one adopted by the fifth convention of the USAI in Montevideo, Uruguay, in March 1947—passed for submission to the Board of Directors of USAI—reads as follows:

"That the participating delegates and official representatives here assembled, who are meeting in accordance with the action of the Board of Directors of USAI and on the initiative of the Argentine Executive Committee of that organization are unanimously agreed upon the desirability of the organization of a Pan American Association of Engineering Societies and believe that a convention for this purpose should take place in the city of Bogota during the year 1948, which convention would be called under the auspices of the Board of Directors of USAI."

The Lima conference agreed that the meeting of USAI, limited to South American engineering societies, which was planned for Rio de Janeiro in 1948, should be expanded into a Pan American Engineering Congress and held during the month of March 1949.

Membership Grade Changes Favored, Answers to Questionnaire Indicate

ELIMINATE the present distinction between civil engineers qualified to be ASCE Members or Associate Members by designating them all as Members; discard the appellation Junior; designate present Juniors as Associate Members, with full corporate rights; create a new non-corporate grade of Student Member; and do not create a new senior corporate grade of Fellow or modify requirements for the grade of Affiliate.

In varying degrees, the foregoing are the answers of the ASCE membership to a questionnaire recently tabulated, with slightly more than 37 percent returns. Results of the returns have been turned over to the ASCE Committee on Membership Grades, of which D. G. Edwards is chairman and V. T. Boughton, H. L. Forshay, J. M. Kennedy and Director Albert Haertlein, are members. While the membership of the committee has changed at various times, the Committee on Membership Grades has been studying ways and means of simplifying membership grades since 1944 (see statement in CIVIL ENGINEERING for July 1947, page 64).

Answering the questions were 1,068 members 27 years old and under, and 7,199 who were older than 27. Juniors responding totaled 2,467; Associate Members, 3,400; Members or Honorary Members, 2,493; and Affiliates, 20

The question regarding amalgamation of the present grades of Member and Associate Member brought 5,500 "yes" votes and 2,726 opposed. There were 4,540 in favor of creating a new corporate grade of Associate Member with the same qualifications as now provided for Juniors, and 3,625 opposed this proposal. Change to some other appropriate title not carrying the word "Junior" was favored by 3,104 and retention of the appellation was favored by 2,449. Full corporate rights for those in the Junior grade were advocated by 4,491 and opposed by 3,211. If a new corporate grade is established, with the designation "Associate Member," those in that grade should have full corporate rights, declared 3,661, while 1,708 opposed the proposition. Creation of a new non-corporate grade for students was favored by 5,240 who advocated calling those in such new grade "Student Members," and by 1,366 who want to call them "Students," while 1,473 opposed such a new grade. There were 3,735 opposed to modification of the requirements for the grade of Affiliate, while 3,120 favored modification. Only 3,149 favored creation of a new senior corporate grade to be designated as "Fellow," while 4,771 opposed it.

Clearest indication of desire for some sort of change in membership grades was the vote on the general question: "Do you favor retention of all titles and qualifications as presently defined in the Constitution for the several grades of membership in the Society?"

Only 2,246 voted "yes," while 5,121 voted "no."

ECPD Pre-Engineering Tests Win Approval of Educators

PARTICIPATION of 40 colleges of engineering in the Measurement and Guidance Project of the Engineers' Council for Professional Development during the past year may result in the adoption of a standardized examination as an entrance requirement of American engineering schools. Commenting on this widely accepted project, Dr. A. B. Kinzel, chairman of the board of the Engineering Foundation, said: "It is increasingly important, in these days of unprecedented demand for trained engineers, that crowded institutions have a standard measurement for evaluating both the qualifications and accomplishment of students as a basis for improved selection and guidance."

As a part of the project, begun in 1943 by the ECPD in cooperation with the Carnegie Foundation for the Advancement of Teaching, 32,000 examinations were given throughout the nation during the past academic year. Of the 40 colleges participating in some way in the project, 39 gave the pre-engineering inventory to all members of the freshman class. A number of colleges which had given the inventory in past years requested that this series of examination be available in a national testing program conducted in advance of matriculation. National examinations were conducted in March, April and June of this year for 2,600 prospective college students. It is expected that in the future a large number of high school seniors will take this series of tests in the nationwide examination.

The pre-engineering examination serves as the official selection test of the Maritime Commission in its Merchant Marine Cadet Corps training program. In November 1946 and March 1947 a total of 1,148 prospective cadets were so tested. Likewise, 699 applicants for the George Westinghouse Scholarships to the Carnegie Institute of Technology were examined last March in the first nationwide testing program.

To evaluate the worth of pre-engineering examinations, the records of students in ten institutions were compared at the end of their freshman year with the results of their pre-engineering tests. Results substantiated the value of entrance examinations in predicting the students' degree of success in engineering training.

Tests developed in connection with the Measurement and Guidance Project of ECPD include the engineering science aptitude test, designed for use in the second year of high school; the pre-engineering inventory, which is particularly appropriate for the guidance of students who have completed their secondary education; a series of achievement tests for sophomore engineering students; and specialized examinations for graduates in the various branches of engineering.

Mining Engineer Wins 1947 Alfred Noble Prize

JOHN H. HOLLOMON, mining engineer and research associate for the General Electric Co., Schenectady, N.Y., has been awarded the Alfred Noble Prize for his paper, "The Mechanical Equation of State," which was published in *Metals Technology* of the American Institute of Mining and Metallurgical Engineers. The prize will be presented at an early meeting of the institute, of which Mr. Hollomon is a junior member.

J. H. Hollomon

Holder of the bachelor's and doctor's degrees from the Massachusetts Institute of Technology, Mr. Hollomon taught in the Harvard Graduate School of Engineering in 1941 and 1942, and served as chief of the physical metallurgy section of the Watertown (Mass.) Arsenal during the war. At present he is directing research in physical metallurgy for the General Electric Co. He is the author of numerous papers on metallurgy and physics, and co-author of a recently published book entitled *Ferrous Metallurgical Design*.

Established in 1929, the Alfred Noble Prize was made possible by a fund contributed by Mr. Noble, one-time President of the ASCE. The prize is awarded annually to a young member of one of the four Founder Societies or the Western Society of Engineers for a published technical paper of unusual merit.

Analysis of EJC Report, "The Engineering Profession in Transition"

Highlights of Report Presented Before Annual Meeting of Arizona Section

JOHN GIRAND, M. ASCE

Johannessen & Girand, Phoenix, Ariz.

For nearly a hundred years the four major groups of engineers—civil, chemical, electrical and mechanical—have gone their ways without much coordination. It has only been in the last few years that any real attempt has been made to unify the engineering profession. All these engineering groups are now coalescing around the Engineers' Joint Council, which is composed of representatives of five national engineering societies. (See "'The Engineering Profession in Transition,' Report on Economic Status Survey," by William N. Carey, ASCE Executive Secretary, in CIVIL ENGINEERING for August 1947, page 13.)

ENGINEERS JOINT COUNCIL has already achieved a number of outstanding accomplishments for the profession as a whole, such as the economic reports on the disarmament of Germany and the one here discussed, the 1946 Survey of the Engineering Profession. This survey was made in cooperation with the federal government and was based principally on a questionnaire mailed to every member of each of the professional societies. A total of 87,000 questionnaires were sent out to a non-duplicated list of professional engineers. The questionnaires covered such items as formal education, annual income, employment status, industrial field in which employed, and similar broad questions relating to the engineering profession. Of the 87,000 questionnaires sent out, more than 48,000 were returned complete, better than 53 percent, which in itself is a significant figure indicating that engineers are interested in a survey of the profession. This 53 percent return on the questionnaire is considerably higher than the percentage that voted on the Society's amendment to increase the dues, which shows that more engineers are interested in knowing about the engineering profession than in raising or not raising engineering society dues.

The data obtained from the questionnaires were punched on cards sorted by mechanical means by the U.S. Bureau of Labor Statistics in Washington, D.C. The report itself was compiled by Mr. Andrew Frazer, a consultant who has had wide experience in work of this type, having organized and administered the 1935 federal survey of the engineering profession and also two special reports on the economic status of members of the American Chemical Society. The complete report, entitled "The Engineering Profession in Transition," is available to members of the Society for $0.50 and consists of over one hundred pages of well-documented statistics. Anyone who is interested in details of the engineering profession with respect to salaries or employment opportunities might well study the report as a whole.

National census figures indicate that there are today about 300,000 people in the United States who classify themselves to the census taker as being in the engineering profession. Of these 300,000, about 90,000 have passed the qualificational requirements of the professional engineering societies. The Engineers' Joint Council report deals with only those 90,000 who have attained the professional recognition available to them through the medium of their technical societies. It is not known how many of the remainder in engineering might qualify if they so desired, as membership in a professional society is not a legal requirement. There are undoubtedly a number in the engineering profession, particularly in federal government engineering, who are not included in the survey.

Civil, electrical and mechanical engineers, each with about 25 percent of the total, constitute the bulk of the engineering profession. Chemical, mining, ceramic and others make up the small remainder. One surprising thing about the survey is what these men do. Thirty percent of them are in administrative positions and are not engineers in the popularly accepted concept of the word. They are department heads, managers, executive officers, and similar people who require a broad background of engineering knowledge in their jobs, and are not necessarily the highly developed technologists who can perform feats of mathematical legerdemain as represented by most of the papers published in ASCE's PROCEEDINGS.

The second largest group, 15 percent, are in design, and these men can be graded as true technical engineers. The third group, 12 percent, are in development and research. These three groups total more than half of all professional engineers, and these men hold jobs where the primary ability required is good judgment. More than half the members of the profession are in a position to make important decisions concerning policy and methods which are reflected in large expenditures of money. This significant fact immediately suggests the possibility of reexamining the engineering curriculum to include business administration at the expense of some purely technical subject.

What these men earn in the way of annual salaries is a much more complicated question than what they do. For one thing, the compilation of statistics as made by the committee, was based on statistical methods which give exact answers as far as basic data are concerned. The interpretation of these data in the form of a report involves some personal opinion. The report followed the general idea of establishing a median, being that figure where 50 percent of the number of people would be above and 50 percent below. This method of analysis includes the people who are receiving exceptionally low salaries in engineering in the order of $200 or $300 a year, that is, those who have failed in engineering, and also includes the men who are making $20,000 or more a year, who obviously are not engineers working strictly in engineering.

If the idea of the median is accepted, certain trends are immediately apparent. First, civil engineers are the lowest paid of all engineers, not by just a little, but by a wide margin. There seem to be two general reasons for this. First, civil engineers as a whole do not have the educational background of other engineers. The survey showed, for instance, that nearly 40 percent of the chemical engineers have masters' degrees as well as bachelors' degrees and 15 percent have doctors' degrees, while in civil engineering only 15 percent have masters' and less than 5 percent have doctors'. The greater earnings of men with better education was established even before this survey, and was reaffirmed by data gathered during the survey.

The second reason why civil engineers seem to be in the lower category is the large percentage that are employed by governmental agencies. In other branches of engineering only 20 percent are employed by governmental agencies, while in civil engineering almost half find their livelihood in working for governmental units. It has long been established, and this survey has reaffirmed the fact, that, in general, engineers in government service receive less than those in private enterprise.

The earning capacity of the average civil engineer increases in an almost direct

ratio with his years of experience, but the earning capacity of the individual varies over an extremely wide range. For instance, a man just entering the profession or with one year of experience can expect a salary range from $200 to $300 a month, while the man with 40 years of experience can expect a salary ranging from $2,400 to $20,000 per year. The average man with 15 years of experience has a median salary of slightly over $400 a month, but the range is from $300 to $700.

For the profession as a whole, young and old, the bulk falls within the range of $250 to $650 a month. In this group are 70 percent of the professional engineers and the group averages $427 a month. This group probably represents the department heads, college professors—the average man that we know in engineering.

Above this 70 percent block there is another definite cluster around the $700 to $800 a month bracket. Of ASCE members, 14 percent are in this group. They average $750 a month and are probably people such as state engineers, chief engineers of local industry and those in similar positions.

The third definite group is an upper crust of about 12 percent who average $12,000 a year. These men are all more administrators than they are technical engineers and it is problematical whether they should be included in a survey of engineering salaries or not. They are men who we might say have graduated from engineering.

At the upper end of the probability curve there are 2 percent who make $20,000 a year or more. It is doubtful if any of these receive their salaries from pure engineering.

Last, but not least, are the 2 percent of professional engineers who have failed in engineering and report annual yearly incomes of less than $300 to $400.

The total money spent on engineering might be of some interest. The average engineer referred to above reported a salary between $2,800 and $6,300 a year. The 25,000 of this group who returned the questionnaire earn a total of over 100 million dollars a year. Those representing this group constitute only a third of the total professional membership. Professional engineers receive, after deleting the upper crust, something over 300 million dollars a year for their services.

This EJC report not only presents information that makes interesting reading, but it also brings to light the glaring inequalities which prevail throughout the engineering profession. As one of the prime purposes of professional societies is to promote the welfare of the engineer, it then becomes a society duty to take this EJC report and carry out a constructive program for the betterment of the profession. Such a program might consist of these items:

1. The necessity for increased education is apparent. Information developed in the report, along these lines, should be presented to Student Chapters and stressed so that as many as possible would take up graduate work on their own initiative, to increase their later earning power, even though their particular school does not require a five-year course. Additional stress should be laid on the necessity of lengthening the curriculum to five years. A greater effort should be made to establish research scholarships and graduate assistance throughout all schools. The 2 percent of the engineers who earn more than $20,000 a year indicates a potential reservoir for graduate student assistance within the profession. A large number of engineers who are in administrative positions should indicate the need for college training in business administration and finance.

It also points out a glaring defect in our publications. Thirty percent of our members are in administrative positions while zero percent of our PROCEEDINGS is devoted to space on administrative problems. It seems probable that a paper on the management of an engineering office would meet with a great deal of sympathetic response.

2. The difference between engineers in governmental service and private employment should be met more aggressively. It is not enough to call in an outside field man to make a salary survey when a threat of salary cuts is made. The survey should be continuous and it is possible that mere publication of the fact that a certain engineering department or office is paying considerably less than prevailing rates would be sufficient to cause the department to increase its salaries or to cause its employees to understand and leave the department for better opportunities.

3. The wide range in earnings of individuals in specific jobs must be adjusted. The man who designs a bridge costing a million dollars and requiring a certain degree of technical ability should not receive $400 a month in one locality and $800 in another. The direct ratio between years of experience in the profession and earning capacity indicates that job classification should include the years of experience in the profession as well as the requirements of the job itself. For instance, among engineers with 30 years of experience there is a spread from $400 to $800 a month in salary rate between the lower 25 percent and the upper 25 percent.

The greatest and most important thing in the survey just made by the Engineers' Joint Council Committee is the fact that it *was made*. Here, for the first time, the national professional engineering organizations have joined together to examine their own shortcomings and, we hope, to correct them.

Value of Cooperation Between Engineers and Architects Emphasized by AIA President

COLLABORATIVE EFFORT between architects and engineers can solve many difficult postwar problems, Douglas William Orr, president of The American Institute of Architects, stated in his address before the recent joint meeting of ASCE's Northeastern Section and the Boston Chapter of the AIA. Mr. Orr's statement that "At the national level architects and engineers find themselves pillars of mutual support," was substantiated by reference to several instances in federal legislation in which joint effort on the part of engineers and architects has yielded results. "The needs of today and the plans for tomorrow," he said, "make it necessary that we strive to know each other better and cooperate in many spheres of activity at all levels."

He stated further that "during the lifetime of these two societies [AIA and ASCE] the whole fabric of our living has been changed. The terrific pace of advancement of the physical and biological sciences has changed the pattern from one of complete simplicity to a highly complex affair. But the specialization, the technical proficiency of which we boast has its dangers. It tends to lead to fossilization and over-emphasis on technology. We of the design professions may well ask ourselves—we have shaped the machine—should we allow the machine to shape us?"

Enlarging on this idea, Mr. Orr continued, "Perhaps one of the faults of all branches of the design professions is that our concern with technology has driven us from contact with man. In an age where the machine looks as though it has almost won the first round over man, the thinkers and forward-looking men of our time are concerned and they have reason to be. We in America have come through two soul-shaking conflicts to bide our time in an uneasy and grim postwar era where there is neither peace nor war. The atom, the smallest particle of matter, looms larger on the horizon than the most enormous battleship. As yet we have not

learned best to utilize the products of our swift advancement and certainly our material gains have brought us no contentment or peace of mind. I believe that to meet this dilemma we must change our sights and try to understand our basic underlying problems, not in terms of technology but in terms of human betterment.

"We members of the design professions must be just as concerned with the impact of our work on the lives of Mr. and Mrs. America as with matters of specifications and use of materials. We cannot forsake the responsibility that the structures which we design are used by men from birth to death, that the cities we alter or create are to serve for human use. Are they sufficient? The demands are enormous but the combined knowledge of the profession is also enormous.

"To get ready for 1960 it would be well for all members of the design professions to survey the fields in which they can be of mutual assistance. I see no reasonable basis on which to define and delimit the spheres of activity of architecture and the engineering sciences. But where all boundaries and artificial limiting points cease is in the field of public welfare, to which all of us should be dedicated. I would like to indicate common fields of activity, common to both architecture and engineering, where the design professions can at this moment render a great service to the nation.

"Today our American cities are in a mess—inadequately planned, overcrowded, dirty, heavily trafficked, and threatened with the perils of decentralization. Our automobiles are beautifully designed mechanisms but they bog down in critical fashion on roads and streets designed for horse-drawn carriages. Parking has become a headache.

"Another field of activity which requires immediate attention from all of us is the matter of 'stabilization'—for want of a better word—of building costs. Unless action is taken in the near future to provide greater efficiency of management and a more productive labor force we may have to admit that we have failed to solve some of America's most pressing problems, providing housing for example, at more moderate rates. Here again architects and engineers can join hands. At present the AIA is attempting to aid a Congressional committee which is investigating building costs. In an added attempt to aid, the AIA has appointed a Committee on Criterja and Standards for Houses, an undertaking we consider exceedingly important. Another AIA committee is trying to bring about a better understanding in the matter of building codes.

"One of the greatest challenges which we face is this matter of urban redevelopment which results historically from the unplanned, centuries-old growth of American cities and their clusters of equally unplanned suburbs. The Urban Redevelopment Committee of the AIA has suggested a three-point attack which will include a statement of the principles of redevelopment policy, a suggested emergency program and a long-range program. It is a cooperative venture in which all engineers and architects must be vitally concerned or they will be evading their responsibilities."

Having posed so many and serious problems, Mr. Orr nevertheless concluded on a hopeful note, again emphasizing the need for cooperation between engineers and architects. "We of the design professions must work together to prove that man is mightier than the machine. Such collaborative effort can master the most difficult tasks."

Engineering Library Has Busiest Year, Survey Shows

USE OF THE Engineering Societies Library in its fiscal year 1946–1947 was 5 percent greater than in the preceding year, according to the report of Ralph H. Phelps, former acting director who became director during the year. Especially significant is the fact that those using the Library by mail increased 9 percent, so that actually 40 percent of those who availed themselves of the Library's services did so without visiting it in person. In the past two years, total use of Library services has increased 20 percent.

All types of services rendered by the Library increased, with the sole exception of translations, which fell off 38 percent in volume of words translated. Photostat prints made increased 12 percent; microfilm orders, 33 percent; number of borrowers, 46 percent; number of books loaned, 48 percent; telephone inquiries, 10 percent; and letters written, exclusive of books orders, 28 percent. The number of searches remained the same.

According to Mr. Phelps' report, the outstanding feature of the year was the thorough study of the Library made by the Committee on Library Objectives and Development, E. F. Church, Jr., chairman. This study shows that since 1941 the cost of important items in the budget has increased from 50 to 65 percent, but in the same period Library income has increased only 18 percent. Severe curtailment of activities has been avoided only by using credit balances accumulated during the war years. The report is the most comprehensive ever made on the Engineering Societies Library.

As the search and translation services were operating at about a 20 percent loss under 1940 rates, the prices charged were raised as follows:

Searches	from $2.50 to $3.00 per hour
Translations:	
German, French, etc.	from $1.00 to $1.50 per 100 words
Russian, Swedish, etc.	from $1.20 to $2.00 per 100 words

Photostat and microfilm rates remain the same, as follows:

Photoprints	$0.30 each ($0.25 each if for a member's *personal* use)
Microfilm	$1.50 for any one article from a single volume of a periodical, regardless of length of article

As in the past the Library has received many valuable gifts of books and magazines. During the year 8,081 volumes, pamphlets, maps, etc., were received by gift and purchase, of which 5,095 were added to the Library. In addition, several thousand reports were received from the Office of Scientific Research and Development and the National Advisory Committee for Aeronautics. The total resources at the close of the fiscal year were 164,051 volumes, 10,316 maps, and 4,943 searches—a total of 179,310 items.

Texas Section Honors Retiring Secretary Focht

PROF. JOHN C. FOCHT, who is retiring as secretary-treasurer of the Texas Section after ten years of service in the post, was honored by the Section at its recent fall meeting. The Section passed a resolution referring to Professor Focht's ex officio duties in "editing and publishing *The Texas Engineer*, executing the orders of the Board of Directors, handling all matters involving finances, and being 'liaison agent without portfolio' between the Texas Section and the Society."

As a more tangible expression of its appreciation, the Section presented Professor Focht with a 16-mm moving picture camera, film, projector, and screen.

Lower Costs Through Greater Productivity Stressed by Construction Group

INCREASED PRODUCTIVITY was stressed as one of the important aids for bettering the construction industry at the November 19–20, 1947, meeting of the Construction Industry Advisory Council in Washington, D. C. Chairman of the Council since its organization two years ago, J. C. Stevens of Portland, Ore., Past-President ASCE, was succeeded in this office by James D. Edmunds, Jr., Past-President AIA, elected at the meeting.

Resolutions passed under the heads of Productivity, Industry Engineered Modular House, Stability, Bidding, Research, Building and Other Codes, Apprenticeship and Training, and Veterans' Housing read as follows:

Productivity

"Productivity in construction, as in other fields, depends upon many factors, including the seasonal and intermittent character of important areas of construction activity, the design of structures, the scheduling and supervision of work, the flow of materials to job site, and the skill and morale of the workers. Both management and labor have an important, direct interest in widening the market for the services of the construction industry by increasing productivity. They should study and explore practical ways and means of increasing production. Such efforts will serve the public interest in an important way by helping to lower costs and to provide for more continuous employment for construction and building trades workers.

Industry Engineered or Modular House

"All branches of the building industry should give encouragement to the industry engineered or modular house program, the purpose of which is to reduce the cost of building homes by bringing to the individual owner and the builder the economic benefits of better coordination of the design of structures, the manufacturing of their materials and equipment, and their assembly on the site. The principles underlying these objectives may be applied by any producer, dealer, designer or builder.

Stability

"Maintenance of a shelf of planned projects capable of being awarded when economic conditions call for such action is recognized to be a promising method of stabilizing construction activity. The Advisory Council recommends adherence to this principle by both private industry and governmental agencies and its effectuation as far as public works is concerned by renewal of the program of federal loans for the advance planning of local public works.

Bidding

"It is in the interest of both public and private buyers of construction that the normal practices of firm negotiations be resumed: firm quotations, firm delivery commitments, and firm orders.

Research

"The Construction Industry Advisory Council is greatly encouraged by the establishment, in the National Research Council of the National Academy of Sciences, of the Building Research Advisory Board under the chairmanship of Dr. Frank B. Jewett. It pledges its full cooperation and support to the activites of this Board which are designed to stimulate technical research and to provide an authoritative clearing house of technical information in the building field. It will carry out this pledge through the Research Activities Committee recently appointed by its chairman to serve as the formal liaison with the Building Research Advisory Board and to take responsibility for providing the necessary underwriting of this important undertaking.

Building and Other Codes

"The construction industry should extend its assistance to modernize building and other codes and to support their sound administration. The only objectives must be to protect the public life, health and property. At the same time there should be permitted the exercise of individual initiative in improving the design, the materials, the equipment, and the methods of assembly into building and other construction. It is important that legal and other obstacles in the way of the use of communities and states, in their codes, of recognized standards or requirements developed through acceptable industry processes and by qualified agencies be overcome, and that means be devised for keeping code requirements in step with the advance of the arts. There is need, also, for greater standardization and coordination of testing methods so that a determination once made of the acceptability of a new material or method of assembly will be more widely used.

Apprenticeship and Training

"While over one hundred thousand young men are being trained as skilled workers in the construction trades, the labor supply is not keeping abreast of requirements, either to meet urgent present demands or for the active years ahead. The development of new methods to shorten the training period and make the apprentice more useful when he goes on the job is, in a number of instances encouraging evidence of cooperation on the part of contractors and labor organizations, but such cooperative actions are far too few. The large volume of construction activity in prospect and the high average age of skilled journeymen make it imperative that industry programs and governmental support for apprenticeship and other training, including refresher courses, be further accelerated and greatly intensified.

Veterans' Housing

"The Construction Industry Advisory Council reiterates its expressed conviction that chambers of commerce, trade associations, and professional organizations throughout the country should encourage community action to assist veterans to obtain needed housing, including rental accommodations."

ASCE Executive Secretary William N. Carey and ASCE Eastern Representative E. L. Chandler attended the Council meeting and, as members on a resolutions committee headed by Robert W. McChesney of Washington, D.C., assisted in developing the resolutions quoted.

Daniel W. Mead Student Prize Goes to Veteran

L. G. LAMON, Marine Corps veteran and member of the University of California Student Chapter, is recipient of the first postwar award of the Daniel W. Mead Student Prize. Presentation of the award was made at the December 16 meeting of the San Francisco Section, at which Mr. Lamon read his prize-winning paper, "The Desirability of a Code or Canons of Ethics for Engineers."

L. G. Lamon

Mr. Lamon graduated from Yuba Junior College in 1940 and entered the University of California, leaving in 1942 to enlist in the Marine Corps. He served as master technical sergeant in a Marine Bombing Squadron for more than three years, and was in the South Pacific for a year and a half. Reentering the University of California in February 1946, upon his discharge from the service, Mr. Lamon graduated in June 1947 with the degree of B.S. in engineering.

Established in 1939 by Daniel W. Mead, Past-President and Honorary Member of the Society, the prize consists of a certificate and cash award of $25. Deferred during the war, award of the prize was reactivated by the ASCE Board of Direction at its 1946 Spring Meeting.

Engineering Institute of Canada Sponsors ECPD Meeting in Montreal

Fifteenth Annual Meeting Plans Expanded Accrediting and Training Program

PLANS FOR A BIG YEAR of training and accrediting were formulated at the annual meeting of the Engineers Council for Professional Development held in Montreal, Canada. As host to the meeting, the Engineering Institute of Canada provided facilities in the spacious Mount Royal Hotel, where the sessions of ECPD and its committees were held during the two days of October 24 and 25.

Accrediting Program Announced

Resumption of the accrediting of college curricula was announced by D. B. Prentice, chairman of the Committee on Engineering Schools. Reorganization of the regional inspection committees has begun and inspections will start immediately. It is planned to examine all accredited colleges within the next three years. Other colleges requesting examination will be given special consideration.

A new subcommittee on graduate instruction has been organized with plans to accredit graduate curricula. Another subcommittee has continued the program of accrediting specialized courses in technical institutes. Dr. Prentice also reported the formation of a special committee to investigate and advise on means of officially reorganizing the curricula and degrees of colleges in Central and South America. This step has been taken to cooperate with the Latin American colleges that have been seeking such recognition.

At the Montreal meeting H. T. Heald, M. ASCE, president of Illinois Institute of Technology, was appointed chairman of the Committee on Engineering Schools.

DUGALD C. JACKSON, M. ASCE, professor emeritus, Massachusetts Institute of Technology, and internationally known educator, addresses session of ECPD in Montreal.

ACKNOWLEDGING RECEIPT of certificate of special recognition presented by EIC, J. P. H. Perry, past Director of ASCE and former chairman of ECPD, addresses ECPD banquet at Mount Royal Hotel, Montreal.

DELEGATES TO ECPD annual meeting get together at Montreal's University Club as guests of Engineering Institute of Canada. Seated around table, left to right, are: A. B. Newman, president, AIChE; N. S. Hibschman, dean of engineering, Pratt Institute; C. L. Davies, executive secretary, ASME; L. A. Wright, general secretary, EIC; Ole Singstad, past Director, ASCE, New York consulting engineer; J. A. Vance, M. ASCE, engineer of Woodstock, Ontario; and W. P. Kimball, Assoc. M. ASCE, professor of civil engineering, Dartmouth College.

ASCE Cooperation Reported

The three representatives of ASCE on the Council, S. C. Hollister, Scott B. Lilly and Van Tuyl Boughton, reported on the past year's activities of ASCE that have resulted from the coordinating efforts of ECPD. Among these is the study of membership grades now under way, which is looking toward establishing a relationship between the membership grades of all professional engineering societies. Also reported was the constitutional amendment giving ASCE Juniors greater recognition including the right to vote. The new ASCE representative to the Council, Director Albert Haertlein, of Harvard University, was also present.

Officers for 1948 Elected

To guide the efforts of ECPD during the coming year, a slate of officers was elected at Montreal. James W. Parker, president and general manager of the Detroit Edison Co., was reelected chairman, and Harry S. Rogers, M. ASCE, president of Brooklyn Polytechnic Institute, was elected vice-chairman. A. B. Parsons, secretary of the American Institute of Mining and Metallurgical Engineers, was elected secretary, and S. L. Tyler, secretary of the American Institute of Chemical Engineers, assistant secretary. Scott B. Lilly, M. ASCE, chairman of the Division of Engineering at Swarthmore College, was appointed by the Council to head the Committee on Professional Training. Likewise Ole Singstad, past Director of ASCE, consulting engineer of New York, was appointed chairman of the Committee on Professional Recognition.

Licensing Needs a "Plus"

Dean Young Warns on Limiting Interpretation of a Professional License

"FAR TOO MANY young men have come to assume that the only thing lying between them and full professional stature is the obtaining of the legal right to practice. Nothing could be more illusory!" warned Dean C. R. Young, M. ASCE, in a recent address. Speaking before the Annual Meeting of ECPD in Montreal, the Dean of the University of Toronto's Engineering College urged the adoption of a new outlook by both young engineers and professional societies if anything resembling "professional status" is to be attained.

Pointing out marked benefits of the licensing movement to the public, Dean Young asked that attention be given lest a license become an end in itself rather than the protection to the public it was intended to be. He explained, "There is no assurance whatever that one so equipped will necessarily be accepted by a discerning and critical public as a person fully entitled to the esteem and deference that by common consent are accorded the members of the older and so-called learned professions. One illiterate or boorish license-holder may offset in the public mind the merits of a score of others about whom there can be no question. The whole profession is compromised by the unacceptable few.

Two Screens Needed

"Not enough weight has been given to general education by either the professional schools of engineering or the licensing associations. Two screens in tandem should be placed in the educational and training stream. The first would function as a selective device to ensure, in so far as may be possible, that those who enter the professional schools have those humanistic and cultural interests and capacities that must be inherent in one who hopes to be accepted as a member of a true profession. The second should be introduced by the licensing bodies in scanning applications for registration as a check on the effectiveness of the first as an instrument of selection of personnel for educational and professional training and as a corrective if it has failed.

"On their part, the licensing bodies should place increasing emphasis on the general educational attainments of those who seek registration. There are still substantial numbers of applicants who base their claims almost wholly on technical knowledge and competency and but little on acquaintance with those things that characterize a broadly educated man. As a result of undue emphasis on the importance of excellence in mathematics and science some men of circumscribed outlook have unfortunately slipped through the universities with small evidences of ability to express themselves clearly or correctly in their own language. The proposed second barrier against illiteracy in professional circles could be introduced by the licensing associations through requiring in respect of the graduates of the professional schools a minimum standing in non-technical subjects and through a corresponding test of those who seek registration through examination.

Learners Should Not Be Leaners

"It is unfortunate that some young men look to the professional associations to do for them what only they can do for themselves. Attainment of that degree of public regard that in effect accords to the one that prompts it a vital place in the community wherein he labors derives from the personal merits of the man himself and not from the bulk or the forcefulness of any organization to which he belongs. One cannot be securely legislated into high places. Professional organizations have a value that is largely limited by technological and economic considerations. They cannot give that quality of understanding, that sympathetic man-to-man relationship that determines ultimate acceptability.

Some Suggested Measures

"While unstimulated awareness of the superior advantages of the well-educated man as contrasted with one of narrow outlook may bring eventual but slow remedy, educational institutions and professional organizations cannot allow the matter to rest there. Positive and definite action needs to be taken.

"On their part the professional schools of engineering should revise upward their standards of admission, at least in so far as general educational subjects are concerned. For example, a bare pass or credit in English ought not to be accepted. A man who is so deficient in the use of his mother tongue as to be wrong as often as he is right in the use or appreciation of the spoken or written word is a sorry prospect for professional eminence. He may be a clever deviser of mechanisms, and an accurate predictor of what they will do, but completely ineffective as a member of a society that depends for its progress on the cooperation of educated men dealing with situations on which their personal specialities have little bearing.

"The professional associations, or licensing bodies, have likewise an opportunity for significant and constructive action. Let them scrutinize with particular care the general educational qualifications of every applicant for admission, whether he comes by way of a university or directly from the shop, office, or field. Examinations for those who are not university graduates might very appropriately include a paper in English."

D.C. Section Committee Formed to Cooperate with Technical Divisions

TO UTILIZE more fully the technical knowledge of its members, the District of Columbia Section of ASCE has organized a Committee on Cooperation with Technical Divisions, as reported in the May 1947 issue of CIVIL ENGINEERING. The committee is to provide the vehicle by which local technical committees will coordinate their own activities and maintain liaison between the committees and the parent Technical Divisions. A membership survey just completed will facilitate the formulation of the local technical committees.

All Section members were invited to express first, second, and third choices as to their interest in the work of the 13 Technical Divisions of the Society. The membership preferences, summarized in Table I, show the possibilities for the stimulation of greater participation in the Society's technical operations. Wide interest was shown, as indicated by receipt of 302 returns from the 450 dues-paying members. One card came from far-away Persia. This possible line of activity aroused the particular interest of Juniors, desireus of extending their participation in the Section. In the variety and breadth of the interests expressed, the D.C. Section may be unique among Local Sections.

Analysis of the distribution of the returns shows a predominance of interest in construction and structural engineering with respect to the first-choice expressions. While to some such an emphasis in the nation's capital may be surprising it is of course explained by the presence in Washington of a local construction industry, supplemented by several federal agencies interested in the planning, designing, and building of public works. Other clearly defined fields of civil engineering follow, in this order: surveying and mapping, highway engineering, sanitary engineering, and hydraulics.

Examination of the over-all results those obtained by lumping first, second

and third choices, shows a different pattern. Construction again heads the list. Next, however, comes engineering economics, which cuts across the major fields. Hydraulics and highway engineering follow in that order.

Objectives to be served by the committee include:

1. **Encouragement of Technical Writing.** Interested individuals will have a channel for submitting papers and discussion to the Society. The local technical committee will also afford a means of securing systematic review of articles in a particular field, and of making assignments to competent persons for needed papers or discussion.

2. **Liaison with Technical Divisions.** This arrangement will aid in keeping the Section better informed as to the work of the Technical Division and will also, importantly, provide a means for the expression of local views on the publication of selected articles.

3. **Appraisal of Research Proposals.** Suggestions for needed research received by the Research Committee are referred to the Committee on Cooperation with Technical Divisions for technical review as to the pertinency of the subject matter, the form of presentation and the scope and promise of the proposed research.

The organization of the Committee on Cooperation with Technical Divisions, including the technical interest of each member, is as follows: E. Robert de Luccia (chairman), Power; R. C. Price (secretary), Engineering Economics; Frank H. Cosgrove, Air Transport; Jacob L. Crane, City Planning; Thomas R. Edmonston, Construction; W. N. Carey, Jr., Highways; Joseph B. Wells, Hydraulics; William E. Corfitzen, Irrigation; Harry B. Shaw, Sanitary Engineering; Thomas A. Middlebrooks, Soil Mechanics; Bernard F. Locraft, Structural; Harry W. Hemple, Surveying and Mapping; and Eugene W. Weber, Waterways.

This sort of Society activity offers ample opportunity for encouraging participation in the technical activities of the Society. During its brief history, the committee has received enthusiastic support. Other Local Sections may find it practicable to adapt to their own situations an activity of this kind. It opens the way for members in increasing numbers to contribute to and to benefit from technical functions of the Society. That makes an important contribution to one of the fundamental purposes of the American Society of Civil Engineers.

TABLE I. PREFERENCES OF MEMBERSHIP WITH RESPECT TO TECHNICAL INTERESTS

Division	Number Expressing Interest as				Percentage of	
	First choice	Second choice	Third choice	Total	First choice expressions	Total expressions
Air Transport	9	11	13	33	3	4
City Planning	18	38	23	79	6	9
Construction	42	42	30	114	14	14
Engr. Economics	22	27	39	88	7	11
Highways	32	22	26	80	11	10
Hydraulics	27	40	17	84	9	10
Irrigation	10	11	17	38	3	5
Power	21	7	9	37	7	5
Sanitary Engineering	28	5	11	44	9	5
Structural	40	25	8	73	13	9
Soil Mechanics	5	20	11	36	2	4
Surveying & Mapping	34	11	10	55	11	7
Waterways	14	17	24	55	5	7
Total	302	276	238	816	100	100

Publication of "Adelantos" to Be Continued in 1948

With the authorization of EJC, plans have been formulated to continue publication of *Adelantos de Ingenieria*, engineering quarterly for Latin Americans, on a self-supporting basis. Funds required to publish the quarterly during the coming year will be sought from manufacturers and commercial firms with foreign interests. Plans call for placing the publication on a self-sustaining basis, starting with the first issue in 1949, by soliciting advertising.

Editorial responsibility for the publication will continue to be in the hands of the Editorial Committee of the Commission on Latin America, operating under the EJC Committee on International Relations. Lloyd J. Hughlett is chairman of the editorial committee, which consists of editors from the Founder Societies and the AIChE.

First issued in 1947 as a cooperative project of the National Research Council, the Inter-American Development Commission of the State Department, and EJC, through its Commission on Latin America, *Adelantos de Ingenieria* has been enthusiastically received by South American engineers. Dean S. S. Steinberg, M. ASCE, of the University of Maryland, is chairman of the EJC Commission on Latin America.

NEWS OF LOCAL SECTIONS

Scheduled ASCE Meetings

ANNUAL MEETING

New York, N.Y., January 21–23
(Board of Direction meets January 19–20)

SPRING MEETING

Pittsburgh, Pa., April 7–9
(Board of Direction meets April 5–6)

Coming Events

Connecticut—Dinner meeting in New Haven, January 28, at 6:30 p.m. Speaker Carlton S. Proctor, newly elected ASCE Vice-President and New York City consultant.

Louisiana—Business meeting at St. Charles Hotel, New Orleans, January 8, at 3:45 p.m.; technical meeting with Society of American Military Engineers at St. Charles Hotel, January 10, at 10 a.m. (in connection with annual meeting of La. Eng. Soc.); annual meeting at New Orleans Athletic Club, January 24, at 8 p.m.

Maryland—Meeting at the Engineers Club, Baltimore, January 14, at 8 p.m. Cocktails at 6, and dinner at 7.

Metropolitan—No meeting in January.

Northwestern—Dinner meeting at Coffman Memorial Union, University of Minnesota, January 5, at 6:30 p.m. Speaker Kerwin L. Mick, chief engineer of the Minneapolis–St. Paul Sanitary District.

Philadelphia—Meeting at the Engineers Club, January 13, at 7:30 p.m. Dinner at 6:30 p.m. Speaker Harrison F. Gonnerman, director of research, Portland Cement Association, Chicago.

San Diego—Ladies' Night at the Tops Restaurant, San Diego, January 27, at 7 p.m.

Sacramento—Meetings at the Elks Club every Tuesday at noon. No meetings on holidays; special meetings as announced in the "Engineerogram."

South Carolina—Annual winter meeting at the Hotel Columbia, Columbia, S.C., January 30, at 10 a.m. Two technical sessions, luncheon, business meeting, and banquet.

Virginia—Annual meeting at the Hotel Jefferson, Richmond, January 30. Afternoon and dinner sessions.

Recent Activities

ALABAMA

ATOMIC ENERGY AND its implications were discussed by Dr. Fred Allison, head of the department of physics, Alabama Polytechnic Institute, at the annual fall meeting in Montgomery. Dr. Allison is credited with discovery of the elements 87 and 85 and of important isotopes, essential to the development of nuclear energy. Other speakers at the two-day session included Ward W. McFarland, state highway director; Melvin R. Williams, district engineer, U.S. Geological Survey, Montgomery; L. M. Smith, vice-president and director of public relations, Alabama Power Co., Birmingham; Robert N. Clark, chief public health engineer, TVA, Chattanooga, Tenn.; Walter B. Jones, state geologist, University, Ala.; Carl B. Fritsche, vice-president, Reichold Chemicals, Inc., Tuscaloosa; and L. A. Woodman, instructor in surveying, University of Alabama. Charles B. Dobbins, editor and publisher of the *Montgomery Examiner*, was the principal speaker at the annual dinner meeting. New officers for the Section, elected during the annual business meeting, are: Walter Scheilke, president; James M. Faircloth, first vice-president; Arthur N. Beck, second vice-president; and Graham P. Willoughby, secretary-treasurer.

ARIZONA

RESOLUTIONS SEEKING TO improve the financial condition of civil engineers were unanimously endorsed by members attending the two-day fall meeting in Phoenix. Citing the EJC report that shows civil engineers to be the lowest paid of all branches of the profession, the Section gave its board of directors a mandate to institute a definite Section program on problems of economic welfare before the spring meeting. The work of testing Army Engineer equipment, especially floating and fixed bridges on the Colorado River, was discussed during the technical session by Goerge W. Howard and John W. Giliberto, of the Yuma Test Branch Laboratory of the Corps of Engineers. Other speakers were W. S. Gookin, of the U.S. Bureau of Reclamation, who described the plan and development of the Central Arizona Project; W. L. Heckler, Contact Member for the University of Arizona Student Chapter, who discussed Local Section responsibility to Student Chapters; and John Girand, Phoenix consultant who discussed the EJC report, "The Engineering Profession in Transition." (See page 53.) A joint luncheon, with the American Association of Engineers, was addressed by W. C. Lefebvre, state highway engineer, who outlined the highway requirements of the state and stressed the importance of sound planning. During the annual business meeting, G. L. McLaine was elected president for the coming year, and George W. Howard, vice-president. V. E. Larson will continue as secretary-treasurer.

CENTRAL ILLINOIS

A JUNIOR BRANCH of the Section has been organized at Urbana, through the efforts of Professors N. M. Newmark and R. B. Peck, of the University of Illinois, and the Juniors of the Section. Most of the 90 Juniors in the new Branch are connected with the university, either as students in the graduate school or as members of the staff. A recent organizational meeting was addressed by George Salter, ASCE Mid-Western Representative, and F. J. Fudge, secretary of the Junior Branch of the Illinois Section. Mr. Fudge discussed the organization and functioning of the Illinois Junior Branch, which has its headquarters in Chicago. Officers of the Central Illinois Junior Branch are: W. M. Munse, president; M. L. Jackson, vice-president; and Clyde Kesler, secretary-treasurer.

CENTRAL OHIO

INSPECTION OF Delaware Dam, and talks by the Army Engineers who are in charge of construction of the project, featured a joint meeting of the Section and the Franklin County Chapter of Professional Engineers. The design, construction, and operation of the dam were described at the dinner meeting following the inspection trip, by Col. Alexander Neilson, district engineer of the Huntington District of the Army Engineer Office, and Harry Pockras, principal engineer. The dam, which is of the gravity earth-fill type of construction with a concrete spillway section, serves a drainage area of 381 sq miles and has a storage capacity of 132,000 acre-ft. Speaker of the evening at a joint meeting with the Columbus Technical Council was Charles A. Scarlott, manager of publications for the Westinghouse Co. Discussing the subject, "Engineering for Tomorrow," Mr. Scarlott described such inventions as X-ray movies with the aid of radar and a gyroscope for railroad cars to eliminate bumping and jolting.

CINCINNATI

A PANEL OF Juniors in the Section presented the technical program at a recent meeting. These were Harry Graham, who described the unique "coyote hole" method used in quarrying operations at Nantahala Dam; Chester Swanson, who explained the use of pumpcrete machines for pouring structural concrete; W. G. Hamlin, who discussed postwar Japan under the American Military Government; and George Kral, who spoke on key considerations in the design of aircraft structures.

CLEVELAND

THE IMPORTANCE OF Junior activities was stressed by ASCE Mid-Western Representative George S. Salter at a recent meeting. Speaking on the aims and activities of the ASCE, Mr. Salter pointed out that the growth of an organization like the Society is inseparably linked to Junior interest and participation in its affairs. At the same meeting Wendell R. LaDue, president of the American Water Works Association, spoke on water supply as a business. The principal speaker at another recent meeting was P. W. Johnston, vice-president of the Erie Railroad Co., who discussed the role of transportation in the future of the country.

COLORADO

THIS YEAR'S OUTPUT of steel will exceed that of all other years in the nation's history, John D. Griffiths, engineer for the American Institute of Steel Construction, Omaha, Nebr., told members of the Section. Addressing the annual meeting on December 8, Mr. Griffiths reviewed the role of steel in our peacetime activities and showed a sound film depicting the various stages of manufacture, from the iron mine to the structural shapes used by the engineer. During the annual business meeting, the following officers were elected for 1948: Alfred J. Ryan, president; Carl A. Gould, vice-president; and John S. Marshall, secretary-treasurer. The federal airport program was discussed at another recent meeting by R. D. MacDonald, district airport engineer for the Civil Aeronautics Administration.

DAYTON

GREAT PROGRESS HAS been made in the development of plastic materials since the war, according to George Ham, research engineer for the Monsanto Chemical Co., who addressed a recent meeting. Dr. Ham displayed many articles made of plastics which will be on the market shortly, and discussed recent developments in the field in their application to industry and commercial products.

DISTRICT OF COLUMBIA

PRESENTATION OF certificates of life membership to eight members of the Section featured the annual meeting. Certificates were mailed to seven other members similarly honored, who were unable to be present. Recipients are: James P. Alvey, W. B. Bennett, Maj. G. M. Chandler, Roy Crum, W. G. Hoyt, F. E. Lamphere, Hugh Miller, Stanley H. Wright, Col. W. J. Barden, R. R. Benedict, W. L. Drager, D. C. Hayne, E. W. James, E. J. Newton, and Col. J. G. Steese. The annual election of officers resulted in the selection of C. D. Curtiss for president; Byron Bird, vice-president; Charles

Stevens, secretary; and Waldo E. Smith, treasurer. Presentation of a film showing the construction of the roads serving the War Department's Pentagon Building concluded the program.

DULUTH

RECENT ACTIVITIES OF the Duluth Section include sponsorship of a highly successful two-day Northern Student Engineering Convention, to which the Duluth Junior College Engineers Club was host. Donald H. Jackson, Section member and instructor in civil engineering at Duluth Junior College, was instrumental in making arrangements. High light of the annual meeting of the Section was the presentation of certificates of life membership to Wayne A. Clark and John L. Pickles.

FLORIDA

USE OF TRANSITE pipe for municipal water supplies was outlined by W. B. Gibson at a recent meeting. Mr. Gibson, who is manager of the transite pipe department of Johns Manville Sales Corp., Atlanta, Ga., supplemented his talk with a sound film demonstrating the use of the product in a typical water supply project built during the war years. Robert M. Angas gave a report on the ASCE Fall Meeting at Jacksonville. Principal speaker at a special joint meeting of the Section and the University of Florida Student Chapter was L. J. Ritter, assistant professor of civil engineering at the university, who discussed soil mechanics.

GEORGIA

THE INDIVIDUAL ENGINEER must contribute more of his time and talents to the community in which he lives, ASCE President E. M. Hastings stated at the annual luncheon meeting on December 6. Mr. Hastings emphasized the necessity for unity of action among all engineers. A special feature of the meeting was the presentation of a certificate of life membership to Thomas H. Winchester. New officers for the Section, announced during the meeting, are: Van Porter Enloe, president; T. H. Evans, vice-president; and George A. Belden, non-resident vice-president. At the conclusion of the luncheon meeting, the group drove to Hapeville, Ga., where they were conducted through the assembly plant of the Ford Motor Co. The large attendance included representatives of the various Georgia technical societies and a group of Georgia Tech Student Chapter members.

ILLINOIS

POSTWAR TRANSPORTATION IN European cities was discussed by Charles E. De Leuw, president of De Leuw, Cather & Co., Chicago, at a joint meeting with the Western Society of Engineers. Mr. De Leuw, who recently visited several of the large cities in England, France, and Holland, compared the relatively light vehicular traffic in the cities visited with our own congested traffic conditions.

INDIANA

ASCE VICE-PRESIDENT Ralph B. Wiley and Mid-Western Representative George S. Salter were guests of honor and principal speakers at a two-day joint meeting of the Indiana and Kentucky Sections, held at Mitchell, Ind. Both discussed Society affairs at the Saturday night dinner meeting, commenting particularly on recent activities of the Board of Direction. Later the group adjourned to take part in the weekly community sing and barn dance, conducted by Dr. and Mrs. Edward Marshall. Sunday morning the group assembled for a showing of the General Electric film "Clean Waters," and later made a conducted tour through Spring Mill Village.

INTERMOUNTAIN

IN THE ABSENCE of the scheduled speaker, members devoted a recent dinner meeting to general discussion of Society and Section affairs. To increase the attendance of younger members and students, it was decided to substitute some low-cost buffet luncheons for the customary dinner meetings.

ITHACA

NEW OFFICERS FOR the Ithaca Section, elected at the recent annual meeting, are: Ernest W. Schoder, president; Frank Bolton, first vice-president; and Raymond Vreatt, second vice-president. Marvin Bogema will continue as secretary-treasurer. The speaker of the evening was Prof. Lyman P. Wilson, of the Cornell University Law School, who gave an account of a recent trip to South Africa.

KANSAS

AIRPORT PLANNING AND the overall needs of air transportation were discussed at a recent meeting by George W. Roseberry, chief of the planning section, Kansas City office, Civil Aeronautics Administration. Speaking on the same program, Harry J. Lichtefield, chief of the airport engineering division, Kansas City office, CAA, spoke on design layouts and the application of the 1946 CAA Congressional Act. The principal speaker at the December meeting was Ben Williamson, chief engineer of the Kansas State Board of Health.

KENTUCKY

THE FUNCTIONING OF the Society was explained in detail by ASCE Vice-President Ralph B. Wiley at the December 5 meeting. Professor Wiley stressed the changing trend of Society interests to include professional as well as technical activities, and described budget curtailments that have been made to meet the higher cost of operation with a fixed income. New Section officers, elected during the annual business meeting, are: W. R. McIntosh, president; Floyd Shrader, vice-president; John S. Kennoy, secretary-treasurer; and J. L. Leggett, corresponding secretary.

LOS ANGELES

CURRENT ATOMIC EXPERIMENTS, and future physiological dangers from atomic radiation, were discussed at the December 10 meeting by F. A. Bryan, assistant director of the atomic energy project and associate professor of medicine at the University of California, Los Angeles. Prof. Wesley L. Orr, of the new college of engineering at U.C.L.A., then discussed the college's plans for the future. High light of the occasion was the presentation of life membership certificates to twelve members. During the evening, the following new officers were installed: Ray L. Derby, president; D. Lee Narver and Arthur G. Pickett, vice-presidents; and Robert J. Kadow, treasurer. George E. Brandow will continue as secretary.

ASCE Western Representative Walter E. Jessup addressed the meeting of the Junior Forum that preceded the main meeting, summarizing the EJC report on "The Engineering Profession in Transition." New Junior Forum officers are: Thomas A. Binford, president; Stanley Goldhaber, vice-president; and John C. Merrell, Jr., secretary.

MARYLAND

RECENT DEVELOPMENTS in the field of plastics will revolutionize modern living, according to L. F. Livingston, manager of the extension division of the DuPont Co. Speaking on the subject of "Research and Better Living" at a joint meeting with the Engineers Club of Baltimore and its affiliated societies, Dr. Livingston described new uses for such materials as nylon and rayon, and emphasized the influence that new developments in the field of plastic research will have on the life of the average person.

METROPOLITAN

A PANEL OF engineers from the Port of New York Authority conducted a symposium on "Airport Development for the New York Metropolitan Area" at a recent meeting. Speakers were James C. Buckley, director of airport development, who described the Port Authority's regional airport studies and its suggestions for operation of LaGuardia, Idlewild, and Newark airports; Hervey Law, general superintendent of airports, who discussed the relationship between design and operation of airports; and A. E. Blomquist, consulting airport engineer, who

outlined the engineering problems involved in the design and layout of major metropolitan airports. An enthusiastic general discussion followed the scheduled talks. Attendance was about 325. At the December meeting Waldo G. Bowman, editor of *Engineering News-Record*, spoke on "European Reconstruction and the Marshall Plan" before an audience of approximately 350.

The Junior Branch of the Section met on December 10 to hear Archie Carter, Washington editor of *Engineering News-Record*, describe engineering design and construction in Cuba. Mr. Carter, who is a former president of the Junior Branch, illustrated his talk with slides he made on a recent Caribbean tour.

MIAMI

NEW FACILITIES THE Florida Power & Light Co. has under construction to meet increasing power demands in the southeast Florida area were described by E. F. Johnson, engineer for the company, at the December meeting. Stating that the present power load is double that of 1935 and that the first of three new units now under construction will not be ready for operation until November 1948, Mr. Johnson recommended that home owners rely on oil rather than electricity for heat during the present winter. Edmund Friedman was elected president of the Section in the annual election of officers, and W. C. Gorman, secretary-treasurer.

MICHIGAN

VETERANS MAKE FINE students, according to Arthur R. Carr, dean of engineering at Wayne University, who addressed a recent meeting in Detroit. The veterans constitute about 90 percent of the present engineering enrolment at Wayne, Dr. Carr pointed out, stating that they are as good students as any who ever attended the college. Other speakers included ASCE Director L. M. Gram, who described the organization and operation of the Society and urged his hearers to take an active part in Society affairs, and G. Brooks Earnest, chairman of the ASCE Committee on Student Chapters, who discussed Student Chapter aims and activities. The principal speaker at another recent meeting was M. P. Brokaw, regional highway engineer for the Portland Cement Association, who described recent developments in concrete road design and construction.

MID-MISSOURI

PRODUCTION OF CONTOURED topographic maps from aerial photographs by the multiplex method was discussed at a joint meeting with the Engineers Club of Jefferson City by C. L. Sadler, central division engineer for the U.S. Geological Survey. Mr. Sadler supplemented his talk with a film, and a demonstration with a multiplex machine was given by A. C. McCutchen and C. W. McCaw, of the U.S. Geological Survey. The Section recently held a meeting in conjunction with the eleventh annual convention of the Missouri Society of Professional Engineers. One of the speakers on the technical program was ASCE Past-President W. W. Horner, whose topic was "Objectives, Procedure, and Some Implications of the Meramec Basin Study."

MID-SOUTH

A DIVERSE PROGRAM of technical papers, inspection trips, and social events featured the two-day annual meeting of the Section, held in Jackson, Miss., December 5 and 6. Speakers on the technical program included James H. Martin, director of the Jackson Building Department, who discussed soils problems in the Jackson area, and Frank Fort, chairman of the Land Use Committee of the Jackson City Planning Commission, who spoke on city planning. Both papers aroused considerable local interest. Special speakers were ASCE Director Harry F. Thomson, who addressed the Friday luncheon meeting on the subject of Society affairs; Tom Q. Ellis, clerk of the Mississippi Supreme Court, who spoke at the annual banquet; and Leif J. Sverdrup, St. Louis consultant, who discussed "American Interests in the Middle East" at the Saturday luncheon. New officers for the Section, elected during the annual business session, are: Lee H. Johnson, president; Eugene F. Bespalow, vice-president; and H. G. Dewey, Jr., secretary-treasurer. There was a record registration of 170 for the two-day session.

NEW MEXICO

IN A TALK on "Interstate River Compacts," given at a recent meeting, John Bliss, state engineer, pointed out the desirability of compacts over court decisions. Mr. Bliss dealt particularly with compacts directly affecting New Mexico, expecially those regulating water use of the Pecos and Rio Grande rivers. A lively discussion from the floor followed his talk.

NORTH CAROLINA

DESIGN STANDARDS FOR interstate national highway systems were described by B. P. McWhorter, division engineer for the Public Roads Administration at Atlanta, Ga., at the all-day fall meeting of the Section. Other speakers appearing on the technical program were: W. H. Meyers, Jr., photogrammetric director, Lockwood, Kessler & Bartlett, Brooklyn, N.Y., who discussed the use of photogrammetric mapping for preliminary highway location; and Kenneth L. Coltrin, chief of the Flood Control Branch of the Norfolk District of the Army Corps of Engineers who spoke on planning and design of the Buggs Island Dam and Power House. Local Section and Student Chapter affairs were discussed by John D. Watson, Section representative at the Jacksonville Meeting, and J. R. Armstrong, member of the North Carolina State College Student Chapter.

NORTHWESTERN

A TALK ON engineering and other conditions in India comprised the technical program at the December meeting of the Section. This was given by L. G. Straub, head of the civil engineering department at the University of Minnesota, who recently returned from a trip to India, where he was consultant to the government on the proposed hydroelectric and irrigation project on the Godavari River. Section officers for 1948 are: Harry L. Wilson, president; Edgar A. Goetz, first vice-president; Charles W. Fritzius, second vice-president; and Frank S. Altman, secretary-treasurer.

PHILADELPHIA

THE EXTREME IMPORTANCE of geologic investigations during studies for large engineering projects was emphasized by Frank E. Fahlquist, consulting engineer and geologist, at a recent Section meeting. Speaking on the subject, "Geology as Related to Civil Engineering," Mr. Fahlquist showed that lack of expert knowledge of earth characteristics can cause disastrous loss of life and money in the construction of dams, reservoirs, power stations, and tunnels. Appearing on the same program, Jack B. Graham, associate geologist for the U.S. Geological Survey, discussed the geology of the Philadelphia region, and Edward J. Watson, professor of geology at Bryn Mawr College, described the geology of the suburban area. The talks were summarized by Joel D. Justin, newly elected ASCE Director and Philadelphia consultant.

SACRAMENTO

ASCE DIRECTOR F. W. Panhorst attended a recent evening meeting and led a discussion of Society affairs. At the same meeting Martin Blote, chairman of the Section's Legislative Committee, described the functioning of the committee and asked for a vote on whether or not Section participation in the Joint Legislative Committee of the state should be continued. The Section vote was in the affirmative. Col. Joseph S. Gorinski, district engineer for the Corps of Engineers, addressed a recent luncheon meeting on the policy of the Corps with particular reference to the construction of the proposed Folsom Dam on the American River above Sacramento.

ST. LOUIS

WHAT HAPPENS IN the Rhine Valley in Germany and the Rhone Valley in France may determine the destiny of Western civilization, according to Waldo Bowman, editor of *Engineering News-Record*, who recently returned from a trip to Europe. In a talk, entitled "Reconstruction Plans and Prospects in Europe"—given at a joint meeting with the Engineers' Club of St. Louis, the St. Louis Chapter of the American Chemical Society, and the Washington University Student Chapter—Mr. Bowman advocated immediate construction of dams to increase the hydroelectric power production of the Rhone and rebuild French industry. Another priority project, he declared, is the clearing of wrecked bridges and other obstacles to navigation from the Rhine because of its tremendous importance as an artery of transportion for German industry.

SAN DIEGO

INSPECTION OF the new 18-acre plant of the National Iron Works highlighted a recent luncheon meeting. Production of the steel fabrication department ranges from 500 to 1,100 tons a month, and the output goes to a wide variety of West Coast industries. As a safety feature, all gas, water, and power facilities are underground. Construction features and operation of the plant were explained by Greer Server, chief engineer of the National Iron Works. Members of the San Diego Branch of the ASME were guests of the Section for the luncheon and inspection trip.

SPOKANE

THERE WAS A capacity attendance at a recent all-day joint meeting with the Student Chapters at the University of Idaho and Washington State College at Coulee Dam. The morning and afternoon sessions were devoted to inspection of the main canal and tunnel near Coulee City, the south dam and outlet works of the balancing reservoir, the north reservoir dam site, the feeder canal, dry dock and bucket repair caisson. Special construction problems encountered in the building of the dam were discussed by L. V. Downs, field engineer for the Bureau of Reclamation at Coulee Dam, at the dinner meeting that followed inspection of the project. The other after-dinner speaker was A. J. Davidson, office engineer for the Bureau of Reclamation, who discussed the general features of the Columbia Basin Irrigation Project.

TACOMA

ASCE WESTERN REPRESENTATIVE Walter E. Jessup attended a recent dinner meeting and led a discussion on Society affairs. Principal speaker on the technical program was Bailey Tremper, chief materials engineer for the Washington State Highway Department, who outlined recent tests made on concrete pipe. The history, manufacture, and use of plywood were discussed at another meeting by Harry R. O'Brien.

TENNESSEE VALLEY

ESSENTIAL NUTRIENTS TAKEN from the soil in large quantities can and must be replaced by mineral nutrients, William Landess told members of the Knoxville Sub-Section at a recent meeting. Mr. Landess, who is head of the program exposition unit of the TVA's Agricultural Relations Department, supplemented his talk on the use of mineral nutrients for soil restoration by means of colored slides.

Guest speaker at a recent meeting of the Holston Sub-Section was George Akin, of Kingsport, Tenn., who discussed the significance of recent chemical engineering developments.

TEXAS

A THREE-DAY fall meeting on prewar scale, held at Fort Worth and Mineral Wells, was a high light in recent Section affairs. The Fort Worth Branch, meeting host, had arranged a diverse technical program. The list of speakers included: Frank C. Clayton, of the Consolidated-Vultee Aircraft Corp., who read a paper on "Runway Requirements for the B-36 Aircraft"; L. S. Waterbury, New York City consultant, who discussed the parking problem on the basis of a parking survey he recently completed for the City of Fort Worth; A. E. Dyatt, assistant superintendent, Airport Branch, CAA, who spoke on standards of airport design; Trigg Twichell, assistant district engineer, U.S. Geological Survey, Austin, whose subject was "Water Resources in West Texas"; and Rex R. Reed, planning engineer for the U.S. Bureau of Reclamation, Amarillo, Tex., who read a paper entitled "Planning the Optimum in Resource Development for Texas." ASCE Director Oscar Koch attended the meeting and spoke on Society affairs during the business session. The annual election of officers, held during the business meeting, resulted in the selection of James P. Exum for president; Mason Lockwood and James K. Alewine, vice-presidents; and I. W. Santry, secretary. The latter replaces John A. Focht, who is retiring as secretary after ten years in that post. A resolution of appreciation for his services was passed by the Section (see page 55 of this issue).

TOLEDO

CIVIL ENGINEERS must seek knowledge in fields outside engineering if they are to make the most of their profession, ASCE Mid-Western Representative George S. Salter told members of the Section at a joint meeting with the University of Toledo Student Chapter. The technical program for the occasion consisted of a talk on the organization and operation of the Ohio State Highway Department, given by W. B. Robison, division engineer.

TRI-CITY

NEW OFFICERS for the Section—elected at the annual meeting in Davenport, Iowa—are: A. R. Boudinot, president; A. F. Burleigh, vice-president; and R. G. Stearns, secretary-treasurer. A talk on "Building Railroads in Alaska" comprised the technical program. This was given by H. P. Warren, chief of the operation division, U.S. Engineer Office, Rock Island, Ill.

VIRGINIA

CONSTRUCTION of the Inter-American Highway was discussed by Hal H. Hale, executive secretary of the American Association of State Highway Officials, at the fall meeting in Roanoke. Other speakers appearing on the afternoon technical program were Student Chapter members. John Cofer, representing the University of Virginia, discussed his practical experiences in the building of a reinforced concrete stadium; T. S. Cook, of Virginia Polytechnic Institute, related his experiences on the construction of the Pan-American Highway; and George Eng, of Virginia Military Institute, spoke on "China Today." Student Chapter activities were discussed in detail at the evening dinner meeting.

WISCONSIN

THE USE OF movable slab forms for building construction was covered by Robert C. Johnson, vice-president of the Siesel Construction Co., at a recent meeting. Use of this type of construction was demonstrated by slides of the construction of the Will Ross Warehouse, recently completed in Milwaukee. The 1948 panel of Section officers consists of: James G. Woodburn, president; O. Neil Olson, first-president; Fred M. Sloane, second vice-president; and Charles W. Yoder, secretary-treasurer.

WYOMING

WYOMING'S IRRIGATION and power development claims in connection with the Upper Colorado River Compact under negotiation between the states of Utah, Colorado, Wyoming, and New Mexico were outlined by State Engineer L. C. Bishop at a joint dinner meeting with the Cheyenne Engineers Club. The lively discussion that followed Mr. Bishop's talk brought out the claims of the other states concerned, and helped give a picture of the problems to be settled before the compact can be completed.

STUDENT CHAPTER Notes

UNIVERSITY OF DETROIT

ACTIVITIES OF THE Society were outlined at a recent meeting by ASCE Mid-Western Representative George S. Salter, who spoke on the relationship of the Society to the Student Chapters. Showing of films on earth-moving equipment and the construction of the Chicago subway concluded the program.

UNIVERSITY OF UTAH

THE UNIVERSITY OF Utah Chapter reports that it has diversified its programs to offset the rather concentrated civil engineering course. A committee of four student officers, under the direction of Don Shaub, senior, plans the programs for the weekly meetings. To date members of the Chapter have heard a lawyer reminisce about his interesting cases; a discussion of the Marshall Plan; a talk on the Central Utah Project; and a discussion of engineering salaries and advancement.

TEXAS TECHNOLOGICAL COLLEGE

CHAPTER OFFICERS FOR the 1947–1948 school year are: Charles E. McQuain, president; Jack Collins, vice-president; and Walter E. McGowan, secretary treasurer. At the first meeting of the new year, Bill Enlow was elected to represent the Chapter on the board of directors for the annual Engineers' Show. Guest of honor and principal speaker at the meeting was ASCE Mid-Western Representative George S. Salter

ASCE PRESIDENT E. M. HASTINGS receives ceramic plaque from Cadet Henry Scott, of Virginia Military Institute, in recognition of his long service as Contact Member for VMI Student Chapter. Presentation was made during recent Chapter meeting, at which Mr. Hastings spoke. Seated in audience are Faculty Adviser Marr (left) and Student Chapter President Matt Moyer.

LEHIGH

Recent speakers at Student Chapter meetings include Paul Karr, engineer of tests at Lehigh, who conducted commercial tests on various building materials; and R. J. McIntosh, manager of sales, Sheet Piling Department, Bethlehem Steel Co., who described the use of sheet piles in the construction of cofferdams. The Chapter's plans for an active year have aroused great interest and nearly doubled the 1946–1947 membership. The new roster of officers is: W. D. McLean, president; D. W. MacDonald, vice-president; W. L. Bencker, secretary; and L. S. Avakian, treasurer.

UNIVERSITY OF ILLINOIS

THE PUBLIC MUST be made to recognize the fact that engineering is a profession, ASCE Mid-Western Representative George S. Salter told members of the Navy Pier Branch of the Chapter at a recent meeting. In explaining the purposes and aims of the Society, Mr. Salter pointed out that the present trend is toward advancing the engineer professionally as well as technically. The Navy Pier Branch of the University of Illinois Chapter, which has its headquarters in Chicago, is taking an active interest in Society affairs.

WAYNE UNIVERSITY

A HIGH LIGHT in the fall activities of the newly organized Wayne University Chapter was a joint meeting with the Michigan Section, which gave an "installation dinner" in honor of the new Chapter. Section officers are: William C. Krell, president; William McClurg, first vice-president; Kenneth J. Baune, second vice-president; Frank E. Jeziorski, secretary-treasurer; and Edward C. Sylvester, Jr., corresponding secretary.

UNIVERSITY OF WYOMING

TO INCREASE PUBLIC and student interest in the Society, the University of Wyoming Chapter is planning to revive such prewar activities as joint Student Chapter meetings and regional conferences. Current officers are: Paul Rechard, president; Robert O'Connell, vice-president; Charles McBeath, secretary; and Jac Logan, treasurer.

COLORADO A & M COLLEGE

ALL-DAY INSPECTION of the Eastern Slope installations of the Colorado-Big Thompson Project constituted a high light in the fall activities of the Student Chapter. The group of about 50 had an opportunity to view a variety of hydraulic installations, including the 13-mile Adams Tunnel and the shorter Prospect and Ramshorn tunnels, Aspen Creek siphon, the Estes Park surge tank, the four large earth dams of the Horsetooth Reservoir, and a number of minor works. At a recent meeting the guest of honor and speaker was H. Y. Hsu, chief design engineer, Yangtze Gorge Project of China, who gave an illustrated lecture on the projected dam project for the Yangtze Gorge just above Ichang, China.

OBJECTIVE OF RECENT inspection trip of Colorado A & M Chapter was Colorado-Big Thompson Project. Photograph (right) shows placing of forms and reinforcing steel for section of Aspen Creek Siphon.

COLORADO A & M COLLEGE group pauses atop Spring Canyon Dam, Horsetooth Reservoir, on inspection trip to Colorado-Big Thompson Project. Fill is about half completed.

NEWS BRIEFS

Construction Volume This Year Expected to Top 1947 Figure by 13 Percent

PHYSICAL VOLUME of new construction next year is expected to be about 13 percent higher than in 1947, David S. Miller, president of the Producers' Council, national organization of building products manufacturers, stated recently. The forecast, based on estimates by the Council's economists, places the 1948 building volume at about 14 billion dollars based on current costs, as compared with an estimated 12.4 billion for this year, but points out that estimates for the second half of 1948 are highly tentative, owing to political and psychological factors which cannot be anticipated with any degree of confidence at this time.

Public Works Account for Half of Increase

Public works and other government financed construction are expected to account for more than half of the anticipated increase. "Public construction next year is estimated at about $3.8 billion, an increase of 30 percent over the 1947 total," Mr. Miller said. "At that rate, the volume of publicly financed construction would account for 27 percent of all new building. Public construction, which totaled 22 percent in 1946, will account for about 24 percent of all new building in 1947. The largest dollar increase in public works is expected in highway construction, which is forecast at 1.5 billion, an increase of about one-third over 1947.

"A slight decline is anticipated in the volume of publicly financed residential building, but expenditures for non-residential projects such as schools, public hospitals, recreational facilities, and administrative buildings are expected to rise to $775 million, an increase of 52 percent. Other public construction, including sewage disposal, water supply, conservation and development work, and airports should increase about 29 percent in value, according to the forecast.

"A gain of about 5 percent is estimated in military and naval construction.

"All values are expressed in terms of costs prevailing in October 1947."

$10.2 Billion Private Building in 1947

"New private building in 1948 is estimated at $10.2 billion, an increase of 8 percent over 1947," Mr. Miller stated. "Private residential construction is expected to rise 12 percent in dollar volume, according to the forecast. An increase of 25 percent is anticipated in commercial building, 11 per cent in farm building, and 14 percent in public utility construction. A decline of 23 percent is forecast in industrial construction. Although the total dollar volume of new construction in 1947 will be about 25 percent higher than the 1946 total, the increase in physical volume will be only about 5 to 10 percent higher."

$6 Billion Maintenance and Repair

Expenditures for maintenance and repair of existing buildings are expected to total about $6 billion in 1948 or about the same as in 1947, according to the forecast quoted by Mr. Miller. "With repair work included, the total volume of all building next year, including new construction, is expected to approximate $20 billion," he stated.

"The demand for repair and maintenance has been especially heavy since the end of the war because such work was curtailed by federal controls until the middle of 1947 and because the high level of incomes has encouraged considerable volume of improvements to homes, farms and places of business.

"Prior to the war, the largest amount spent for repairs and maintenance in any one year was $3.6 billion in 1929. Expenditures for improvements and repairs rose to new records during the war and the result is reflected in the recent sample housing census made by the Bureau of the Census. According to the Bureau's report, only 7.9 percent of all non-farm housing units needed major repairs as of April 1947, whereas the 1940 census had reported 14.1 percent in that category.

"Although improvements such as reroofing, insulation, new plumbing installations, painting, and other maintenance work may have taken nearly one-third of the building materials utilized this year and may require an equal quantity in 1948, the percentage taken from next year's increased production will be smaller."

1948 Supply Situation Predicted

The building materials supply situation in 1948 is expected to vary from "comfortable" to "fairly adequate" with the probable exception of steel and steel products, according to the Producers' Council forecast quoted by Mr. Miller.

"The coming year will see a further improvement in the supply of the vast majority of materials, and a continued building up of dealers' inventories," the spokesman for the Producers Council said. "This forecast must be qualified, however, in view of the announcement that the Administration is seeking authority for allocation and control over the use of basic products. Even though housing or construction as a whole might receive favorable treatment in such a control system, the imposition of controls could seriously interfere with the progressive reestablishment of orderly markets.

"The degree of materials shortages next year also will partly depend upon ultimate

Tests Ruggedness of Shipping Container

RESISTANCE TO rough handling, protection against roll and vibration stresses, and immunity to water spoilage are merits claimed for 276-cu ft welded steel shipping containers developed by the Dravo Corporation of Pittsburgh. Handling lugs are recessed in upper corners shaped to take container legs, permitting close tier storage. Under severe test, container is lifted by two rear lugs so that full weight of 14,000-lb contents is thrust against double doors secured at top and bottom by latches as protection against theft. Doors are framed by 11-gage steel stripping rendering container weathertight.

decisions in respect to foreign aid. So far as building materials are concerned, the indirect impact of a foreign-aid program, accompanied by steel and freightcar shortages, is likely to be more important than direct demands for building products.

"The physical volume of total new construction expected to be put in place during 1948 is 10 to 20 percent below the 1941 volume. During the summer months of 1947, production of most building materials was at or above the average rate of 1941 output. If this rate is maintained the difference between physical construction volume and materials production should provide an ample margin for an increase in inventories plus, in some cases, more deliveries to foreign countries. For there was no semblance of materials shortages in 1941."

Economical Airport Planning Requires Cooperation of Airport and Aircraft Designers

Timely Subject Is Discussed at Meeting of Automotive Engineers

THAT COOPERATION between airport and aircraft designers is necessary for the establishment of fixed standards for airports was brought out by Harry Otis Wright, Jr., M. ASCE, chief engineer of Public Airport Services, Inc., at the recent National Air Transport Engineering Meeting of the Society of Automotive Engineers in Kansas City, Mo. In his paper on "Economical Airport Planning" Mr. Wright stated that the most important objective of economical airport planning is the establishment of fixed standards for airports so that they can adequately accommodate present and future aircraft with a minimum amount of construction. "The method of establishing such fixed airport standards is probably the most controversial question in airport planning today," he said. Excerpts from his paper follow.

"During the seven-year period beginning July 1, 1946, the federal government will make available $500,000,000 to the local governments for the construction of new airport facilities under the Federal Airport Act. The communities will spend a much larger amount in airport construction pursuant to this act, for in no case will the federal contributions exceed 50 percent under the law, and in many cases, such as hangars, no federal participation will be involved. In addition, the larger communities, such as New York and Chicago, will receive in the way of federal assistance only a small amount of the costs which these communities will bear in constructing the facilities. Accordingly, during this seven-year period much more than a billion dollars will be spent in airport construction.

"Unless a substantial portion of this amount is to be ineffectually used, a greater amount of cooperation and coordination between the *airport* designers and the *aircraft* designers must be accomplished. The rapid developments daily occurring in the design of aircraft, particularly the transport and combat types, make this cooperation imperative if the airports now being built are to adequately serve the aircraft of even the near future.

"The goal toward which we should strive is to plan airports which will adequately serve present and future aircraft requirements and at the same time require the smallest possible amount of construction so that the burden upon the communities of building, operating and maintaining the airports will be decreased to the minimum. Whether this ideal can ever be reached is highly speculative. However, it should be possible to determine standards at this time which will at least substantially accomplish the ideal objective.

"The Civil Aeronautics Administration recently held hearings in Washington attended by members of the aviation industry and local governments for the purpose of assisting the CAA in formulating new runway standards. At this hearing, it was evident that there exists a serious difference of opinion with regard to whether such fixed runway standards can be accomplished. The cities and states which have the burden of furnishing a large proportion of the construction funds, and the sole burden of maintaining and operating the airports, took the position that the aircraft of the future should be designed to operate from the airports now being constructed under the Federal Airport Act. The aircraft industry on the whole felt that such a position might constitute a serious restriction upon the development of future aircraft.

Recommends Joint ASCE and SAE Committee

"It would appear that the answer to the problem can best be obtained by lengthy discussions and compromises among the industry members, both the airport designers and the aircraft designers, in which a sound standard for the future can be devised. A hearing before a government agency can never accomplish this result because there is not sufficient opportunity for the necessary give-and-take discussion so essential to reaching desirable compromises. Therefore, I suggest that a standing joint committee composed of representatives of the American Society of Civil Engineers, the Society of Automotive Engineers, the Institute of Aeronautical Sciences, and other industry members, be established at once for the purpose of accomplishing coordination between airport and aircraft design, and to help the CAA establish standards which the local governments can economically follow in constructing new airports.

"The adoption and acceptance by the industry of fixed standards for airports, particularly for the larger communities, and the single long or heavy runway plan for the small communities would effectuate savings of substantial amounts in airport construction and would guarantee to the aircraft industry an adequate network of nationwide airports which would be capable of accommodating at all times the latest type of aircraft coming into production."

More Engineers Are Needed by Bureau of Reclamation

SUPPLEMENTING its previous announcements of open examinations for certain engineering positions with the Bureau of Reclamation, the U.S. Civil Service Commission has announced similar open examinations (until further notice) for positions in Grades P-2 and P-3 carrying salaries of $3,397 and $4,149 a year, and in Grades P-5 to P-8, carrying salaries between $5,905 and $9,975 a year. These positions are in all branches of engineering including civil, construction, hydrology, irrigation, materials, structural, electrical and mechanical.

The announcement states that applications are desired from individuals whose training and experience qualify them particularly for engineering or engineering administrative work within the specialized scope of the Bureau of Reclamation. Positions are to be filled in the states of Oregon, Washington, California, Arizona, Nevada, Idaho, Montana, Wyoming, Colorado, New Mexico, Utah, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas.

Basic requirements for Grades P-2 and P-3 include an engineering bachelor's degree or four years of progressive technical engineering experience. For Grades P-5 to P-8, four years of progressive technical engineering experience are required and also bachelor's degree, or a combination of the two. Additional requirements for Grades P-5 to P-8 include four years of broad and progressive professional engineering experience. No written test will be given. Candidates will be rated on their training and experience relevant to the duties of the position.

Information and application forms may be secured from most first- and second-class post offices, from Civil Service regional offices, or from the U.S. Civil Service Commission, Washington, 25, D.C.

Code Encourages Use of New Materials and Methods

FLEXIBILITY IN BUILDING REGULATIONS and wider use of more modern materials and methods are claimed as benefits which will follow general adoption of a new national building code drawn up by 70 experts for the Building Officials Foundation organized last year by the Building Officials Conference. The publication *Business Week* reports that the code will soon be published for study and criticism by the building industry for which a sum of $600,000 is sought to finance the foundation—$60,000 has already been raised.

Setting up of performance standards for materials, with the Foundation itself a testing agency, instead of mere specification of materials allowed in construction as now followed in many local building codes, was the original intention of the framers of the new code, but reports indicate a compromise had to be made among the views of the national consultants, on its purely functional purpose.

Influence of Toll Bridges on Highway Traffic Is Subject of Report

RECENT STUDIES of two toll bridges over the Kanawha River near Charleston, W.Va., by the Yale Bureau of Highway Traffic, indicate that amortization over long periods of time through funds collected as tolls tends to create a reservoir of stranded traffic, diverting a large percentage of the total volume to free facilities. Removal of tolls increased traffic over the two bridges studied by as much as 53 percent, thus relieving congested conditions on two nearby free bridges.

Another observation included in the report on "Toll Bridge Influence on Highway Traffic Operation," is that "motorists place a high cash value on their time." Using a mathematical formula for evaluating the time saved by highway users of toll facilities, provided the origin and destination of traffic are known, the report shows that in West Virginia motorists value their time from seven-tenths of a cent to slightly more than one cent per minute. It shows, on the other hand, that when the Boston Post Road and Merritt Parkway are compared on the basis of the same formula, the motorist traveling between New York and New Haven values his time up to 1.28 cents per minute.

Further findings listed in the report, which was prepared by M. Earl Campbell, formerly state planning engineer of the West Virginia State Road Commission and now with the Highway Research Board in Washington, D.C., include the following:

1. The toll system is generally accepted as an expedient, as a questioned resource.
2. Public impatience for eliminating or reducing tolls on a facility increases with time. A toll project which elicits public favor in the beginning may be the object of marked disfavor in the end.
3. There must be a positive economic and social need for the toll facility coupled with an economic environment adequate to support the toll system and amortize the debt in a reasonable length of time.
4. The accrued community benefits from a toll facility must outweigh the economic and social disadvantages which it incurs.
5. Generally, the toll facility should be operated under public ownership, or authority, and on a self-liquidating basis.
6. The perpetuation of tolls on a fully amortized facility to protect the financial stability of an adjacent toll structure may not be necessary. Each toll bridge is inherently protected if sufficient distance and travel time separate it from the next adjacent bridge. Each situation should be the subject of a special study in cause and effect.
7. Toll systems have a profound economic and social effect upon a community.

Conference Promotes Closer Relations Between Contractors and Government Agencies

PROMOTION OF closer relations between contractors and government agencies in the interests of more efficient work was advocated by Col. W. W. Wanamaker, District Engineer, Baltimore Engineer District, in a recent address before a group of some 40 engineers and contractors at his office in Baltimore, Md. Discussing projects in his district to be constructed in 1948 at an estimated cost of $24,000,000, the Colonel said, "The general purpose of this meeting is to acquaint you with our program in the construction field and to give general contractors information in order to assist them in determining which of these projects prove most interesting from a specialized point of view." He stated further that he had always found it conducive to greater efficiency when relations between contractors and government agencies were pleasant and more clearly understood."

Included in the 1948 program of the Baltimore Engineer District are eight flood control projects—three at Williamsport, Pa., three at Sunbury, Pa., and two at Elmira, N.Y., all of which will lessen flood dangers in the Susquehanna Valley. Military work comprises three veterans' hospitals—at Wilkes-Barre and Harrisburg, Pa., and Baltimore, Md.

Speaking for the engineer-contractor group, which included several ASCE members, D. W. Winkelman, Syracuse, N.Y., expressed thanks to Colonel Wanamaker and his staff for "taking us into your confidence and talking over the future work of your office." He stated further that the conference "has been of service to all of us."

Traffic Volume Strains City Streets and Highways

AN INDICATION of the problem that is beginning to plague officials who must provide adequate facilities for traffic expansion is seen in a recent study made by the Public Roads Administration. Traffic volume in July 1947, according to statistics compiled by PRA, shows a sharp increase over the same period in 1946. Current monthly trends show similar increases over corresponding months in 1946, resulting in greater strain on all existing street and highway facilities.

Main-road traffic for July 1947 showed an increase of 11.9 percent over the same month in 1946, and city street traffic increased 5.8 percent in the same period. On rural roads the monthly traffic was 9.8 percent over July 1946 and 3.3 percent above that for July 1941, setting a new all-time high record of vehicle miles on rural roads in a single month.

In a traffic-trend bulletin based on PRA records, the traffic engineering division of the National Conservation Bureau, accident prevention section of the Association of Casualty and Surety Companies, notes a sharp increase in traffic volume during 1946 when an all-time high of 340 billion vehicle miles was reached. This figure is 3.6 percent greater than the previous record of 1941 and 65 percent above that for the war year 1943.

Traffic fatalities in 1946 according to the National Safety Council were 33,700 (less than 10 per 100 million vehicle miles). This figure is 16 percent below the 1941 total. Compared however with actual totals for 1945, with no consideration of increased volume, fatalities in 1946 were 20 percent higher—33,700 against 28,070.

Predicts Increase in Traffic Volume of 50% in 10 Years

TRAFFIC VOLUMES will increase 50 percent in the next ten years and add appreciably to the congested and hazardous conditions of city streets, Henry K. Evans, Assoc. M. ASCE, director of traffic engineering for the National Conservation Bureau, told officials of Williamsport, Pa., when he presented a final report on traffic conditions in that city. The 84-page report, detailing the results of a traffic survey made in Williamsport by the Bureau, was presented at a luncheon attended by city officials and members of local civic and safety organizations.

A study of traffic accidents in Williamsport over the past seven years revealed 41 deaths, 1,225 injuries and direct economic losses totaling $629,000, Mr. Evans reported. He urged the city to speed adoption of 43 recommendations outlined in the Bureau's report to reduce the accident rate, relieve traffic congestion and provide adequate parking facilities. The Williamsport survey was one of several recent studies made in cities of varying sizes by the Bureau, the accident prevention division of the Association of Casualty and Surety Companies.

Engineering Progress Show Scheduled for May 11 to 16

JUNIOR MEMBERS of the Engineers' Club of Philadelphia and the Franklin Institute of the City of Philadelphia are cooperating in sponsoring a second Engineering Progress Show in Franklin Hall, Franklin Institute, Philadelphia, May 11 to 16. The presentation will be similar to the first show which attracted more than 10,000 persons last year, and will feature exhibits depicting progress in engineering.

Nationally prominent engineers are being lined up for lectures during the show, and exhibitors now are contracting for booth space.

Committee Provides Guidance for Prospective Engineering Students in New York

IN COMPLETING ITS tenth year of service to high school students contemplating careers in the engineering profession, the New York Engineers Committee on Student Guidance, operating under the auspices of Engineers' Council for Professional Development, visited 26 high schools in the metropolitan area during the 1946–1947 season.

To carry on the work for which it was organized, the committee is currently composed of 80 members of the NewYork (Metropolitan) Sections of ASCE, ASME, AIME, AIEE, and AIChE. Small committees, generally five, constitute the usual panel for the visit to a particular high school, upon invitation of the school principal. Their function is to supplement with specific information the general background material already disseminated by the school's vocational counselors.

Short talks are given to groups of high school students explaining the functions of the engineering profession as a whole, the specialties of each branch, how an engineer is trained, and the personal qualifications and aptitudes needed to be an engineer. These visits feature a period in which students (and sometimes their parents) ask questions of the committee members. The meeting is terminated with a consultation period in which any student may ask in private any question concerning personal guidance.

Formation and operation of this committee has been motivated by the wide discrepancy between the numbers of freshmen that enter engineering schoools and those that graduate. The information provided enables prospective students better to evaluate their aptitudes and inclinations. The committee definitely avoids "selling" an engineering career to students; it is especially anxious that students who do not possess the needed basic aptitudes be advised to prepare themselves for other fields of work.

The committee is expanding its service so as to cover a wider territory within the New York metropolitan area. To carry on this increased work it is seeking additional volunteer members from the engineering profession. A large number of engineers are known to find satisfaction in helping to advise individual prospective students; this opportunity may now be realized with much wider effectiveness.

Civil engineers who are willing to participate in this worth-while work are requested to communicate with the chairman of the ASCE subcommittee, Alfred T. Glassett, Assoc. M. ASCE, vice-president, Wm. J. Barney Corp., 101 Park Avenue, New York 17, N. Y.

Pavement Surfaces Tested for Skid Characteristics

IN MORE THAN 1,000 measurements in tests made during a nine-month study by the Virginia State Highway Department, 27 out of 32 types of pavement were found to have satisfactory skid resistance qualities under wet conditions, and all gave satisfactory results when dry. Using natural and synthetic tires with good and worn treads at speeds of 10–40 mph, the tests showed that good treads offer greater resistance to skidding than smooth or worn tires, particularly on fine-textured surfaces.

Stopping distances on wet surfaces at a speed of 40 mph were generally 40 percent greater for worn than for good treads. Smooth synthetic tires under comparable conditions gave skidding distances about 12 percent greater than for smooth or worn prewar treads of natural rubber. At 40 mph, skids ranged from approximately 64–89 ft on dry surfaces and from 72–225 ft on wet surfaces. At the same speed new synthetic tires gave an average stopping distance of 70 ft on dry and 93 ft on all types of wet surfaces tested.

The tests were conducted mostly on high-type pavements, including bituminous concrete, sand asphalt, special plant-mix, rock asphalt, sand and slag seal treatments, broom drag treatments, portland cement concrete and glazed bituminous surfaces.

It was on surfaces with excess asphalt treatment that the least skid resistance and the greatest stopping distances were recorded. Under wet conditions, one of these pavements showed a skidding distance of 18 ft at 10 mph, 72 ft at 20 mph, 160 ft at 30 mph, and 254 ft at 40 mph.

Surfaces with a harsh, sandpaper-like texture were found to have short stopping distances, while long stopping distances were recorded on smooth, glazed surfaces. Application of non-skid treatment to smooth highways materially reduced the stopping distance. In one case, the skids measured on a wet surface at 40 mph were reduced from 224 to 94.7 ft after application of non-skid material.

The test car was a standard 1946 model 4-door sedan. Making a run, the car was leveled off at its test speed and the brakes instantly applied, locking all four wheels. At the instant the wheels locked, a detonator fired a chalk bullet onto the pavement. The stopping distance was measured from the chalk mark to the gun after the car had stopped. No attempt was made to measure side skidding. Results of the studies, made by T. E. Shelburne, M. ASCE, director of research, and R. L. Sheppe, Virginia Highway Department, are now published by the Highway Research Board, Washington, D.C.

Entire City Is to Be Surveyed from the Air

SETTING A PRECEDENT in the East, an entire city, New Rochelle, N.Y., is to be topographically mapped by aerial surveying or photogrammetry. The survey will provide a series of maps, on a scale of 200 ft to the inch with 5-ft contours, showing buildings, streets, parks, rivers and other features; a single over-all map 600 ft to the inch with 10-ft contours; and aerial photographs of the city.

Similar methods have been used for mapping smaller areas such as the 13×1-mile strip between New Britain, Conn., and Charter Oak Bridge in Hartford.

New Rochelle authorities placed the aerial mapping contract with the Photogrammetric Division of Lockwood, Kessler & Bartlett, Inc., Brooklyn, N.Y. Estimates indicate that the cost will be about 25 percent of that required for conventional ground surveys, and that the survey will take about six months as against approximately five years required for a ground survey.

Air Line Completes Part of $6,000,000 Program

FORMAL OPENING recently of Delta Air Lines' new headquarters adjoining its enlarged operating and maintenance base at the Municipal Airport in Atlanta, Ga., marks completion of one of the most fully integrated airline facilities in the South. Strategically located with respect to present and proposed passenger terminals, Delta's million-dollar expansion more than doubles the line's plant and office area in Atlanta, where a $6,000,000 municipal airport improvement program is under way.

Designed and built by The Austin Co. to provide compact and efficient facilities for the 1,000 maintenance and office personnel employed at Delta's principal traffic center, the enlarged layout includes executive and general offices, a new steel frame maintenance hangar with 187-ft span and 32-ft clearance for major overhaul of the largest planes in the line's service, plus extensive shop areas and an engine test building with two test cells, where a special installation of acoustical materials in the stacks has provided effective noise control.

The new hangar, with a clear depth of 150 ft, supplements space in an existing 150-ft span hangar, which is now available at all times for routine line service activities required by the airline's expanded operations. Total hangar area available is 40,000 sq ft.

Western Motor Carriers Form Research Institute

MORE ACTIVE PARTICIPATION of the Western motor transportation industry in matters of highway financing, location and construction is presaged in a recent announcement that leading Western interstate truck operators have joined together to finance a highway and taxation research organization, to be known as the Western Highway Institute.

The new organization, in charge of directors selected by the Western trucking associations, has established headquarters in San Francisco, Calif. In addition to accumulating research material for the Western trucking groups, the Institute will cooperate in close cooperation with the American Trucking Associations and other organizations active in the highway transportation field.

The Institute will soon begin long-range studies in truck taxation, highway planning and vehicle design. All work will be concentrated in eleven Western states only.

Virginia Will Spend $40,000,000 for Road Improvement in 1948

VIRGINIA'S LARGEST APPROPRIATION, $20,-79,646 including $2,108,035 in federal aid, r construction and maintenance of its ,000 miles of secondary roads during the cal year 1948–1949, has been announced the State's Department of Highways. his sum exceeds the 1947–1948 grant by bout 1½ million dollars. In addition, a m of $20,000,000 has been set aside for nstruction on the state's 9,000-mile pri-ary system during the same period. These penditures are part of an estimated half-illion dollars to be spent on highway nstruction and improvements over the xt 20 years.

Virginia is one of four states in the nation which is charged with the administration of virtually the entire rural road network within its boundaries. Direct administration by the highway department of farm-to-market roads has simplified handling of federal grants for secondary highways. Contracts have been let for virtually all of the first-year funds and a good part of the second-year funds have been programmed.

Since 1932 when the state took over the county roads, unimproved road mileage has decreased from 25,000 to 5,000. (For a comprehensive account of Virginia's 20-Year Plan for highway improvement see CIVIL ENGINEERING, December 1947, pp. 18–22.)

County Plans to Extend and Operate City Airport

IN AGREEMENT with city authorities who ve had charge of the Rochester, N.Y., air-rt for many years, preliminary surveys d planning are under way for expansion d operation of the facilities by the Monroe unty Board of Supervisors. Expected to gin in the spring of 1948 and to extend er a four-year period, the project includes gthening of existing runways, construc-on of new runways, taxiways, a new ad-inistration area and building, and addi-ons to the present lighting system, at an imated cost of $4,500,000.

Reconstruction of the airport, aided by vil Aeronautics Administration funds, is sed on designs being prepared by Seeley, evenson and Value, ASCE members, w York consulting engineers, who will o supervise the work.

Steel Production in 1947 Presages Big Output in 1948

PRODUCTION OF MORE than 84,000,000 s of steel in 1947 greatly strengthened industrial economy of the United States, d accelerated the operations of many er industries, according to a recent an-uncement by Walter S. Tower, president, erican Iron and Steel Institute. This nage sets a production record for a peace-e year.

Mr. Tower explains that "The principal son for continued inability to meet every mand for steel has been the loss of more n 18,000,000 tons since the end of the r as the result of strikes and work stop-ges." Larger output may be hampered insufficient quantities of good-quality p, he said, which is the major reason y the industry was unable to operate at capacity in 1947. Total domestic and ign demands are expected to remain avy. Steel production in 1948 should al or exceed the output of 1947, barring erruptions from work stoppages or kes and assuming there will be no short-s of raw materials of the proper quality.

In 1948, steel companies will have the benefit of some of the new producing facilities which have been under construction for a year or more, according to Mr. Tower. These are part of the industry's billion-dollar expansion program. Since the current scale of demand is abnormal and temporary, Mr. Tower points out that a balance between supply and demand for all types of steel may be reached by the expected high production of 1948.

Geological Survey Maps North Carolina Highways

COMPLETION OF PLANS for surveying and mapping some 3,000 sq miles in central North Carolina by the U.S. Geological Survey, in cooperation with the state's Highway and Public Works Commission, is announced by Secretary of the Interior J. A. Krug as the initial step in improving and widening the interstate highway system under the national postwar highway development program. Equal sums of $50,000 for the survey will be contributed by the Highway Commission and the federal government during the next two years.

Areas to be mapped extend from Winston-Salem and Greensboro in the north to Charlotte in the south. Maps and aerial photographs will serve as guides to highway officials in selecting suitable routes to meet increasing traffic demands. To permit highway planning and design studies to begin without delay, map compilations will be supplied to state engineers as soon as completed.

Uniform Code Announced for Small Jurisdictions

RELEASE OF a new "Uniform Building Code for Small Jurisdictions" was announced by the Uniform Building Code Association, national affiliate of the Pacific Coast Building Officials Conference, to the 270 members of the organization attending the 25th Annual Meeting held recently at the Grand Canyon in Arizona.

The new document is an abbreviated form of the basic document, the Uniform Building Code, and the small code is designed for jurisdictions of under 10,000 population, and to apply only to buildings not over 7,500 sq ft in ground floor area. The small code requires that all other structures comply with the parent Uniform Building Code, latest edition.

ASCE Members to Direct Moles' Award Ceremonies

THREE MEMBERS of the American Society of Civil Engineers, Charles B. Spencer, New York, Gen. Brehon B. Somervell, Pittsburgh, and Richard E. Dougherty, New York, will play prominent parts in conducting the ceremonies in the Roosevelt Hotel, New York, February 4, at which The Moles, New York society of tunnel and heavy construction men, will present their annual awards "for outstanding contributions to construction progress." Recipients will be Lt. Gen. Raymond A. Wheeler, Chief of Engineers, U.S. Army, and William A. Durkin, president, Walsh Construction Co.

As president of The Moles, Mr. Spencer will serve as master of ceremonies for the award presentations. General Somervell, winner of The Moles Award in 1944, will make the speech introducing General Wheeler, and Mr. Dougherty will speak as sponsor for Mr. Durkin. The function will be attended by 700 leading engineers and construction men.

Highway Research Board Holds Annual Meeting

A RECENT SPEED-UP in highway construction, despite the problem of high costs and limited supplies, was reported by C. D. Curtiss, deputy commissioner of the Public Roads Administration and secretary of the ASCE Highway Division's executive committee, at the 27th annual meeting of the Highway Research Board, held recently in Washington, D.C. In the latter part of 1947, the volume of highway construction averaged $80,000,000 monthly, Mr. Curtiss told the 850 highway experts in attendance. Subjects discussed in the 120 papers and reports presented at the four-day meeting included the human element in accidents, the need for polarized lighting to eliminate glare, heavy motor vehicle operation, highway planning, and traffic accident costs.

Featured at the general session on December 3 was the presentation of the Highway Research Board Award for a paper on airport runway evaluation judged of outstanding merit to Dr. Norman W. McLeod, of Canada.

F. V. Reagel, engineer of materials, Missouri State Highway Department, was elected chairman of the Board's executive committee, and Prof. R. A. Moyer, Assoc. M. ASCE, of Iowa State College, vice-chairman. Pyke Johnson, president of the Automotive Safety Foundation, was re-elected to the executive committee.

American Engineers Aid Turkish Government in Planning National Highway System

TWELVE CIVIL ENGINEERS of the Public Roads Administration left this country recently to assist the Turkish Ministry of Public Works in laying out a comprehensive system of all-weather highways. Headed by Harold E. Hilts, Assoc. M. ASCE, Deputy Commissioner, and Jesse E. Williams, Assoc. M. ASCE, the engineers will be joined by a small group of mechanics, machine operators and supervisors to train Turkish nationals in the various branches of road construction and maintenance, according to a recent announcement by Thomas H. MacDonald Hon. M. ASCE, Commissioner of Public Roads.

Mr. Williams, with wide experience in highways and forest roads, will be division engineer in charge of the American group with an office at Ankara. Mr. Hilts will remain only long enough to direct preliminary stages of the work. Expanding its highway department, the Turkish Public Works Ministry will cooperate with the division engineer's office in all planning and construction agreed upon as satisfactory to both agencies.

Specialists in planning, design, construction, bridges, testing materials, maintenance and equipment and finance, the American engineers will give first consideration to roads urgently needed, as Turkish economy has been greatly handicapped by lack of good motor roads.

In his comments on the Turkish road-building program Commissioner MacDonald made the following statement:

"Since funds are limited it seems desirable to resort to the policy of stage construction that has been used successfully in this country. Under this policy low and medium type surfaces are built with standards for grade and alignment suitable for progressive improvement. A high-type surface may be placed when required by traffic without loss of the initial investment."

American aid, mostly for machinery, equipment and general mission expenses, will be financed to the amount of $5,000,000 assigned by the State Department from the Turkish Aid Fund created by Act of Congress early in 1947. Equipment valued around $750,000 has been bought from the Army and is being shipped to Turkey. Right-of-way costs, labor, materials and detailed supervision will be paid by the Turkish Government which tentatively proposes also to finance a mission of Turkish highway engineers to this country where the PRA has agreed to arrange for their training in laboratory procedure and field construction.

Bid Calls on Western Projects Announced by Bureau of Reclamation

UNDER THE HEADING of "Bid Calls Expected This Month," the Bureau of Reclamation's *Advance Construction Bulletin* for December 1 announces work about to go forward on several large projects in Western States. According to the bulletin, all information published is subject to revision, but the data given will serve as a guide to the nature, size and location of the proposed construction.

COMPLETION OF DAM

Anderson Ranch Dam, Idaho

Location: South Fork of Boise River, 30 miles northeast of Mountain Home.
Work: Completion of excavation for spillway and outlet works; completion of placing concrete and reinforcement bars for spillway and outlet works; construction of power plant; installation of penstock and outlet pipes; installation of valves, gates, cranes, and hoists.

Excavation for spillway and outlet works	54,000 cu yd
Stockpile excavation	37,000 cu yd
Reinforced concrete	41,000 cu yd
Placing cobble and rockfill	54,000 cu yd

Time Allowed for Completion: 850 days.

PIPELINE AND STORAGE TANKS

Boulder Canyon Project, Nevada

Location: Boulder City, Nev.
Work: Furnishing and installing six miles of 12- and 14-in.-dia high-pressure steel pipe and erection of one 50,000- and one 2,000,000-gal storage tank.

Excavation	39,000 cu yd
Steel tanks	800,000 lb
Concrete	40 cu yd
12-in. steel pipe	265,000 lb
14-in. steel pipe	1,510,000 lb

Time Allowed for Completion: 270 days.

PIPELINES AND STRUCTURES

All-American Canal Project, California

Location: Vincinity of Indio and Coachella, Calif.
Work: Construction of structures and pipelines for distribution system in Units 2 and 3, including placing of 75 miles of precast concrete pipe from 12-in. to 45-in. diameter.

Excavation, pipe trenches	266,600 cu yd
Concrete in structures	810 cu yd

Time Allowed for Completion: 400 days.

PUMPING PLANTS

Klamath Project, Oregon-California

Location: Vicinity of Tulelake, Ore.
Work: Construction of pumping plants G, H, I, K, L, and M.

Excavation	4,600 cu yd
Placing 18- to 30-in.-dia concrete pipe	1,000 ft
Concrete	600 cu yd
Installation of pumping units	75,000 lb

Time Allowed for Completion: 240 days.

PUMPING PLANT

Klamath Project, Oregon-California

Location: Near Merrill, Ore.
Work: Construction of Adams 60-cfs pumping plant with wooden superstructure.

Furnishing and placing reinforcement steel	52,000 lb
Miscellaneous metal work	3,000 lb
Installation of pumping units	18,000 lb
Excavation	3,300 cu yd
Furnishing and placing trashrack structures	9,000 lb

Time Allowed for Completion: 180 days.

WASTEWAY

Owyhee Project, Oregon

Location: Vicinity of Nyssa, Ore.
Work: Construction of earthwork and structures for approximately 3.5 miles of Locket Gulch Wasteway.

Excavation	280,900 cu yd
Furnishing and placing reinforcement steel	242,800 lb
Concrete	2,045 cu yd

Time Allowed for Completion: 270 days.

WASTEWAYS

All-American Canal Project, California

Location: Vicinity of Indio and Coachella, Calif.
Work: Construction of earthwork and structures, and lining Wasteways 2 and 3 for flood protective works.

Excavation, channels	371,000 cu yd
Excavation, structures	24,600 cu yd
Concrete, channels	9,200 cu yd
Concrete, structures	1,830 cu yd

Time Allowed for Completion: 360 days.

CANAL

Central Valley Project, California

Location: Near Visalia, Calif.
Work: Construction of earthwork, lining and structures of approximately 14 miles of Friant-Kern canal.

Excavation	2,803,000 cu yd
Concrete	97,000 cu yd

Time Allowed for Completion: 700 days.

TUNNEL AND CANAL

Riverton Project, Wyoming

Location: At the confluence of the Wind and Big Horn rivers near Pavillion, Wyo.
Work: Construction of Muddy Ridge Tunnel, approximately 2,870 ft long, about 2,000 ft of Wyoming Canal and extensions; about 2,000 ft of lateral.

Excavation	113,900 cu yd
Concrete	3,400 cu yd
Furnishing and placing steel tunnel supports	190,000 lb
Furnishing and placing reinforcement steel	188,000 lb
Timber lagging	113 Mbm

Time Allowed for Completion: 600 days.

PENSTOCKS

Davis Dam Project, Arizona-Nevada

Location: 30 miles west of Kingman, Ariz.
Work: Construction of five 22-ft-dia welded, plate steel penstocks.

Time Allowed for Completion: 500 days.

R. Robinson Rowe, M. ASCE

"This is a coincidence!" exclaimed Professor Neare. "Just before Adam Scrubal's scheduled talk on 'Esthetics of Elliptical Traffic Circles,' we are to discuss the location of a traffic circle so as to minimize travel between 3 cities."

"An ambiguous problem," alleged Titus Wadham. "You located the cities at 3

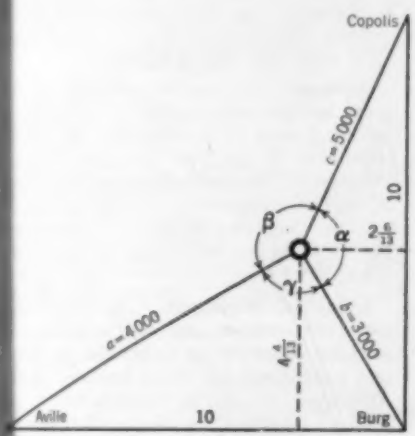


Fig. 1. Traffic circle in a three-point location.

corners of a 10-mile square and gave the traffic density, but did not specify the radius of the traffic circle. If we can neglect travel in the circle, suppose we make its radius 7.07 miles so that all 3 cities are on the circle and the effective radial travel is zero! If we can't neglect travel in the circle, is it fair to neglect the complete loops of bewildered drivers who miss the exit the first time around?"

"We'll neglect all quibblers and pragmatists," growled the professor.

"That excludes me in," said Joe Kerr. "I worked this problem once before and remembered Steiner's general solution that the 3 radial roads must protract equal angles of 120 deg. This clue made it an easy 3-point problem and I found the traffic center 2.988585 miles northwest of Burg."

"Joe's good memory forgot one thing," protested Cal Klater. "Steiner's problem was to minimize road mileage, not traffic mileage. This is a sequel to the Steiner problem with distances weighted by relative densities of traffic and analogous to the problem of static equilibrium of 3 forces proportional to these densities. The general solution may be expressed:

$$\sin \alpha : \sin \beta : \sin \gamma = a : b : c$$

where a, b and c are the radial densities and α, β and γ are the corresponding 3-point angles (see Fig. 1).

"In this case, $a:b:c$ = 4,000:3,000:5,000, so we may take for the 3-point angles those whose sines are 0.8, 0.6 and 1.0. Then any of various 3-point methods can be used to find the coordinates of the traffic center, 32/13 miles west of the Burg-Copolis meridian and 56/13 miles north of the Aville-Burgline. The aggregate daily travel is then $10{,}000\sqrt{65}$ = 80,623 vehicle-miles, compared to 90,000 via section-line roads and 72,426 via direct roads."

"Fine work, Cal. I can only add that the radial distances are in the proportion 7:4:5 and that the general method is practical in determining how near a highway through Aville and Copolis should come to a city near the direct line.

"Our new problem involves traffic in another way—the revenue from parking meters, all in pennies and nickels. A miserly traffic engineer, counting the day's gate, stopped to ponder when he noticed that the pennies came out even in rolls and found that if the number of nickels had been squared, the gate would have been three times as much as if the number of pennies had been squared. How much was the gate?"

[*Cal Klaters were Richard Jenney, Paul Seide, Ralph W. Stewart, A. Nuther Nutt, John L. Nagle, Ignor Antenuff (Paul Hartman) and Anne Othernut (J. Charles Rathbun). Also acknowledged are solutions from Uppan Atom (Count Harvey) of the lawn-mowing problem and from J. M. Brandstetter of the odd-weight weighing problem who proves that the answer should be 39 instead of 38.*]

Meetings and Conferences

American Road Builders' Association. The postwar highway construction program will be discussed in detail at the 45th annual convention of the American Road Builders' Association, to be held in Washington, D.C., January 26–28. Registration at the Mayflower, Statler, and Willard Hotels, January 26, at 8:30 a.m. The Airport Division of the ARBA will hold its annual meeting at the Mayflower Hotel, January 27, at 10 a.m

American Society of Heating and Ventilating Engineers. Every known device for promoting indoor comfort in an adverse climate will be exhibited at the 8th International Heating and Ventilating Exposition of the American Society of Heating and Ventilating Engineers, to be held in Grand Central Palace, New York City, February 2–6. Admission by invitation only.

Second National Materials Handling Exposition. Cost reduction through improved handling is the theme of the Second National Materials Handling Exposition, scheduled to be held at the Public Auditorium, Cleveland, Ohio, January 12–16, inclusive.

Society of Automotive Engineers. The annual dinner meeting of the Society of Automotive Engineers will be held in the Masonic Temple, Detroit, Mich., January 14. Application for tickets ($6 each) should be forwarded to SAE headquarters, 29 West 39th Street, New York City.

Plan Meeting of American Concrete Institute

MEMBERS OF CONVENTION COMMITTEE of American Concrete Institute plan features of annual convention, to be held in Denver, Colo., February 23–26. Highlights of diversified program include inspection of engineering laboratories of Bureau of Reclamation, field trips to nearby construction projects, and exhibits by construction industry. Photograph shows, left to right, Stephen H. Poe, Bureau of Reclamation, convention publicity; E. W. Thorson, Assoc. M. ASCE, Portland Cement Association, chairman of convention committee; O. O. Phillips, M. ASCE, R. J. Tipton & Associates, Inc., exhibits; Robert F. Banks, M. ASCE, Bureau of Reclamation, vice-president of ACI; and H. S. Meissner, M. ASCE, Bureau of Reclamation, program chairman. Messrs. Blanks and Meissner are recipients of Society's Thomas Fitch Rowland Prize (see page 46 of current issue).

Wool Gatherings by WOOLLEY

THE BELL XS-1, powered by a 4-unit rocket engine, is capable of going 1,700 miles an hour at an altitude of 80,000 ft.

108,000,000 PERSONS in the United States lack adequate water supplies.

FLOODS on the Mississippi in June reached crests that topped all-time records.

FIFTEEN POUNDS of plutonium can generate as much heat as 6 trainloads of coal.

LACK OF trained engineer personnel—because of low salaries—has hampered road building in 40 states.

DROPPING DRY ICE into a cumulus cloud from a high-flying plane produced a rainfall that lasted all afternoon and covered 20 sq miles of country about 100 miles north of Sydney, Australia.

WHEN MIXED in a new whitewash formula, DDT now works effectively in killing insects for 10 months.

A 10-IN. CRUDE-OIL pipeline 181 miles long is to be built to carry crude oil from the Rangely, Colo., oil fields to salt Lake City; estimated cost is $5,000,000.

CALIFORNIA has recently broadened its registration law to cover civil, chemical, electrical, mechanical and petroleum engineers. Mining engineering is left out.

A SEVEN-YEAR construction program to bring some 5,000,000 acres under irrigation has been started by the Siamese Government.

THE STATE of Washington's highway department employees are the best paid in the 11 Western states.

SEVENTY-FIVE-TON girders, 56 ft long, were too long and too heavy to be hauled over city streets in Rochester, N.Y.; they therefore traveled 166 miles by barge to get them from the Odenbach Shipbuilding Corp. plant on Dewey Avenue to the Brooks Avenue bridge, a distance of 15 miles.

THE COLLEGE of Engineering, University of Illinois, has been closed to further registration.

LAST YEAR property lost by fire cost Americans over $560,000,000.

A NEW asbestos-fibered aluminum roof coating reflects up to 80 per cent of destructive sun's rays and lowers temperatures under the roof 10 to 15 deg and makes the roof last longer.

New Publications

Engineers' Salaries. A 24-page booklet on "Incomes of Professional Engineers in Public Employment," prepared by Arthur Richards, M. ASCE, past-president of the American Association of Engineers, has been released by the Association. The publication contains grade descriptions for subprofessional and professional classes of engineering positions; discusses salaries in 1938, 1942 and 1947; compares salary increases with cost of living; explores the influence of size of population served; and offers a proposed guide for establishing equitable salary ranges for nine engineering grades. Copies are availabe at $1 each from the American Association of Engineers, 8 South Michigan Avenue, Chicago 3, Ill.

Runway Maintenance. The first bulletin in a projected maintenance series for airport managers has been issued by the Airport Division of the American Road Builders Association under the title of "Maintenance of Concrete Runways, Taxiways and Aprons." The 30-page illustrated bulletin—written by W. R. Macatee, manager of the Airport Division—may be purchased for 50 cents from the American Road Builders Association, 1319 F Street, N.W., Washington 4, D.C.

Housing Developments. Examples of rental housing developments, built and financed by private enterprise with mortgages insured by the Federal Housing Administration, are given in "Neighborhoods Built for Rental Housing," recently released as Land Planning Bulletin No. 4 by the FHA. Copies of this 24-page illustrated bulletin are available without charge to local planning boards from local FHA offices or from the Washington, D.C., office. Copies are available to the public from the U.S. Government Printing Office, Washington 25, D.C., at a cost of 15 cents.

Highway Research. The triaxial compression method of testing soils and application of the test data to the design of flexible pavements, as developed by the engineers of the Kansas State Highway Commission during the past six years, are described in Bulletin No. 8 of the Highway Research Board. Inquiries should be addressed to the Highway Research Board, 2101 Constitution Avenue, Washington 25, D.C.

Industrial Waste. Methods for determining, measuring and controlling industrial wastes are thoroughly covered in a 103-page illustrated volume, *Industrial Waste Disposal for Petroleum Refineries and Allied Plants*, recently released by the National Petroleum Publishing Co. The book may be purchased from the W. C. Platt Co., 1213 Third Street, Cleveland 13, Ohio, at a cost of $4.

Steel Products. Three new sections in the Steel Products Manual, which is being issued in installments by the American Iron and Steel Institute, are now available, at a cost of 25 cents, from the Institute, 350 Fifth Avenue, New York, N.Y. The present bulletins are Section 1, on "Pig Iron and Ferroalloys"; Section 3, entitled "Tie Plate Designs and Punchings"; and Section 12, dealing with "Hot Rolled Carbon Steel Strip."

Railroad Transportation. In "What's Ahead for the Railroads," the Association of American Railroads reprints two chapters from the 391-page final report of its Railroad Committee for the Study of Transportation, entitled *Transportation in America*. The present reprint outlines the general railroad situation and legislation affecting it. Inquiries should be addressed to the Association of American Railroads, Transportation Building, Washington 6, D.C.

Hydraulic Engineering. The application of wartime developments in the fields of hydraulic engineering and fluid mechanics to peacetime problems is discussed in the *Proceedings of the Third Hydraulics Conference*, released by the State University of Iowa as Bulletin 31. The Proceedings—edited by J. W. Howe, M. ASCE, and J. S. McNown, Assoc. M. ASCE—cover the 1948 conference, a cooperative project of the Iowa Institute of Hydraulic Research and the State University of Iowa. Copies may be obtained from the Department of Publications, State University of Iowa, Iowa City, Iowa, at a cost of $2.50 each.

Bridges. Photographs of some of the great bridges built by the New York consulting firm of D. B. Steinman, M. ASCE, constitute a 24-page brochure, entitled "Bridges." A brief history and description of each structure supplement the photographs. Inquiries should be addressed to D. B. Steinman, 117 Liberty Street, New York, N.Y.

Industrial Standards. The fourth in a series of standards applying the principle of modular coordination to building materials and equipment has been released by the American Standards Association. The present standard, dealing with "Sizes of Clay Flue Linings," may be obtained from the American Standards Association, 70 East 45th Street, New York 17, N.Y., at a cost of 35 cents a copy.

Airport Runways. Results of an investigation of the runways at a number of the principal airports in Canada are reported in Research Report No. 4B of the Highway Research Board, entitled *Airport Runway Evaluation in Canada*. Norman W. McLeod, author of the report, received an award for the report at the recent annual meeting of the Highway Research Board. Inquiries should be addressed to the Board, 2101 Constitution Avenue, Washington 25, D.C.

Registration of Engineers. A 1947 edition of the Digest of state laws governing the practice of engineering and land surveying and of State Board procedures has been published by the National Council of State Boards of Engineering Examiners. In three folded tables and 28 pages of textual supplements it lists the complete details of requirements in 48 states, Alaska, Hawaii, Puerto Rico, and the Model Law. The 23 pages of text give a summary of Board procedures pertaining to uniformity of requirements, examinations, reciprocity, and related matters. Copies are available at $2 from Keith Legare, Executive Secretary, NCSBEE, P.O. Drawer 1404, Carolina Life Building, Columbia, S.C.

NEW IN Education

ESTABLISHMENT OF "universities" for graduate engineers as an aid to the professional man just out of college was announced before the council of The American Society of Mechanical Engineers by its president, Eugene W. O'Brien of Atlanta. The council meeting in Atlantic City immediately preceded the five-day annual meeting of ASME there. According to the new program, an innovation in engineering education sponsored by the Engineers' Council for Professional Development, these "universities" will be set up in key cities throughout the nation. A pilot program is already under way in Detroit where the local engineering society and some 30 local sections of national technical societies will give courses, lectures and consultations to engineer graduates. The faculty will be composed of outstanding engineers in active duty in the area.

RESEARCH PROJECTS are already under way in the new hydraulics laboratory of the Georgia School of Technology, according to an article by Associate Professor Carl E. Kindsvater Jun. ASCE, in *The Research Engineer*, journal of the school's Engineering Experiment Station. Equipped through the generosity of two anonymous donors, the laboratory can solve problems concerned with production of hydroelectric power, conservation and regulation of domestic and industrial water supplies, flood control, spillway models, river navigation models, navigation locks, design of household plumbing fixtures, and general fluid-flow investigations.

A RESEARCH PROJECT to study and develop new and improved drainage methods for Utah's irrigated lands has been made possible by a $10,000 grant from the Utah Power & Light Co. to the Utah State Agricultural College.

MODERN METHODS of teaching sanitary engineering received an impetus with the recent dedication of the William Thompson Sedgwick Laboratories of Sanitary Science at Massachusetts Institute of Technology. Designed to provide the student with a thorough knowledge of the chemical and biological reactions which take place in the treatment of water, sewage, and industrial wastes, the new facilities consist of three laboratories—for sanitary bacteriology and research, sanitary chemistry, and sanitary engineering. Dr. John B. Wilbur, M. ASCE, head of the department of civil and sanitary engineering, presided at the dedication exercises. Speakers included three ASCE members: Prof. William E. Stanley, in charge of the new laboratories, who emphasized their value for thesis projects and for advances in research; Arthur E. Weston, M. ASCE, chief engineer of the Massachusetts Department of Public Health, who spoke on laboratory training and sanitary engineering practice; and Dr. Gordon M. Fair, M. ASCE, dean of engineering of the Harvard Graduate School of Engineering, who discussed the laboratory and sanitary engineering education.

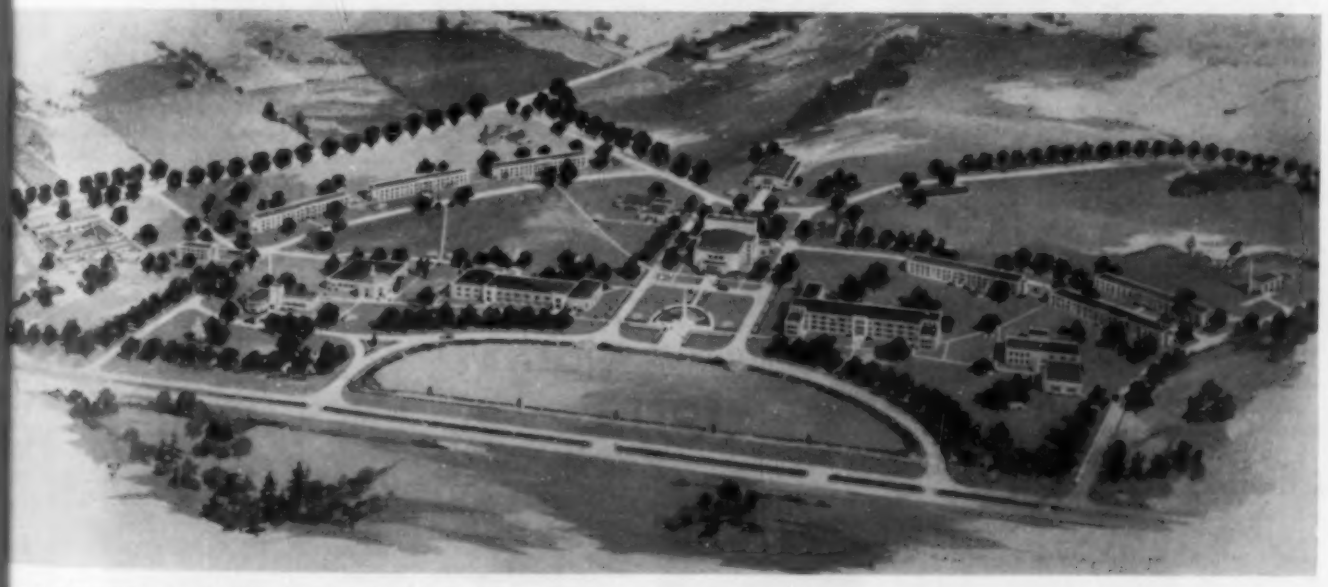
Postwar Teaching Problems Discussed at ASEE Meeting

MANY URGENT PROBLEMS raised by postwar doubling of enrolments and faculties were discussed by engineering teachers from 27 colleges in five states at the annual meeting of the Middle Atlantic Section, American Society for Engineering Education, held at Pratt Institute, Brooklyn, N.Y., December 6.

A session on the general theme of the engineering teacher and his skills was followed by twelve conferences on special topics. Separate sessions considered counseling and testing; use of visual aids such as projectors and motion pictures in technical education; course problems in English, mathematics and the several fields of engineering, and the place of the library in engineering education.

The civil engineering group, under the chairmanship of Prof. E. K. Timby, Assoc. M. ASCE, of Princeton University, conducted discussions led by several ASCE members—Professors H. L. Bowman of Drexel Institute, W. S. LaLonde, Jr., of Newark College of Engineering, J. M. Garrelts of Columbia University, and J. O. Eichler of The Cooper Union.

Teamwork Completes $3,500,000 College Campus in One Year



CONSTRUCTION OF COMPLETE university campus including 19 buildings with 440,000 sq ft of floor space at Greenville, S.C., in period of one year and in time for opening of 1947 fall term, has been possible through close cooperation of owner, architect and builder. Owner, Bob Jones University, in need of immediate expansion impossible at old location in heart of Cleveland, Tenn., let contract for new site to Daniel Construction Co. of Greenville, before architect James G. Gauntt, M. ASCE, of Chattanooga, and associate architect Leon Le Grand of Greenville, knew location of project and before plans were drawn. Owner-architect-contractor team worked out master plan with locations of buildings and utilities to permit orderly future expansion. Team chose functional mass silhouette for architectural treatment, designed to use materials quickly obtainable for fireproof construction. At cost of $3,500,000, or less than $8 per sq ft, unit provides facilities for 2,400 students. Ultimate expansion to 8,000-student capacity is envisioned.

last longer.

NEWS OF Engineers

Rear Admiral Reuben E. Bakenhus, CEC, USN, retired, has been elected secretary of the American Institute of Consulting Engineers, New York City, succeeding the late **Philip W. Henry,** M. ASCE. Entering the Navy Civil Engineer Corps in 1901, Admiral Bakenhus was commissioned rear admiral in 1932 and retired with that rank in 1937. Since his retirement he has had a consulting practice in New York City, specializing in waterfront and harbor work, valuations, and expert court testimony. Active in the Society and Metropolitan Section, he served as ASCE Director from 1943 to 1945.

R. E. Bakenhus

Lawrence Talma Smith, principal architectural engineer of the Maryland State Health Department, has been honored with the grade of societaire of the Societe des Ingeneurs Civils de France. During the war, Colonel Smith filled various general staff and engineering assignments in French North Africa, and later was consulting engineer to the Ministry of Communications, the Chinese National Government, and UNRRA on the rehabilitation of the destroyed railroads of China. At present he is in charge of the coordination of the Maryland Hospital Construction Program.

H. H. Roberts, partner in the engineering firm of Moffat, Nichol & Roberts, Los Angeles, Calif., is chief engineer for Ozark Dam Constructors on the Bull Shoals Project. He was formerly chief engineer for the contractors, Pacific Naval Air Bases, during the construction of the Navy's advanced base depot at Port Hueneme, Calif.

Robert S. Taggart has accepted a position as assistant sanitary engineer for the National Biscuit Co., in New York City. Except for a period of wartime service in the Army Sanitary Corps, Mr. Taggart has been district engineer for the New York State Department of Health at Amsterdam, N.Y., for the past eleven years.

Gerald H. Frieling director of research for the Kansas City Public Service Co., Kansas City, Mo., has been named vice-president in charge of transportation. The governor of Missouri recently appointed Mr. Frieling to represent management in the newly created State Mediation Board.

Walter J. Kackley has resigned as consulting engineer for the Public Buildings Administration, Federal Works Agency, Washington, D.C., to join the engineering staff of the U.S. Atomic Commission in Washington.

Eldon J. Yoder, formerly of the Purdue University research staff, has accepted a position as assistant professor in the civil engineering department at Ohio State University.

William A. O. Wurts, assistant city engineer of Hartford, Conn., has been named the first manager of the Hartford Metropolitan District Commission in the initial step of the district's projected reorganization plan.

William R. Seeger was recently appointed assistant chief engineer of the Marin Municipal Water District, with headquarters in San Rafael, Calif. He was previously project manager of the engineering office of Clyde C. Kennedy, San Francisco.

Robert A. Thompson, Jr., is now assistant to W. D. Masterson, manager of the San Antonio, Tex., water system. Before joining the water board, Mr. Thompson was an Army engineer on military construction in Texas, Oklahoma and New Mexico.

Col. George W. Gillette, who is retiring as division engineer of the South Atlantic Division, Corps of Engineers, Atlanta, Ga., has accepted an appointment as executive director of the North Carolina State Ports Authority, with headquarters in Wilmington, N.C. Colonel Gillette will begin his new duties on January 1.

George E. Lyon has severed his teaching connection at the University of Minnesota to become assistant professor of civil engineering at Cornell University.

Hayse H. Black has accepted an appointment as associate professor of sanitary engineering at the University of Iowa. Until lately he was in Detroit, Mich., as officer in charge of the U.S. Section, International Joint Boundary Commission Water Pollution Investigation.

Mark G. Knight is now city engineer for Grand Coulee, Wash. He was previously concrete engineer for the Lehigh Portland Cement Co.

Homer A. Hunter has resigned as city manager of Lubbock, Tex., to establish a private consulting practice in engineering and management. During Mr. Hunter's two years as city manager, the city started the largest public works improvement program in its history. He will open his office in Dallas, Tex., early in January.

Sumner C. Willis is general superintendent in charge of construction of the first peacetime atomic pile at the Brookhaven National Laboratory on Long Island. Mr. Willis is construction superintendent for the H. K. Ferguson Co., industrial engineers and builders in charge of engineering and construction of the project.

Norman Kruchkow has severed his connection as engineer in the New York district of the U.S. Engineer Office to become assistant plant manager for the contracting firm of M. Gottfried, Inc., Stamford Conn.

Thomas R. Klingel, formerly division engineer for the Minneapolis, St. Paul & Sault Ste. Marie Railway, Minneapolis, Minn., is now assistant professor of civil engineering at the University of Minnesota.

James K. Finch, dean of the Columbia University School of Engineering, was named an "Officer del'Instruction Publique" and received the French "Ordre des Palmes Academiques" at a ceremony held at the office of the Cultural Division of the French Embassy on December 3. A former Director of the Society, Dean Finch has been associated with the Columbia School of Engineering since 1911.

Norman W. McLeod, consultant to the Canadian Department of Transport, is this year's recipient of the Highway Research Board's annual award for an outstanding technical paper. The prize-winning paper, entitled "Airport Runway Evaluation in Canada," was presented at the 26th annual meeting of the Highway Research Board.

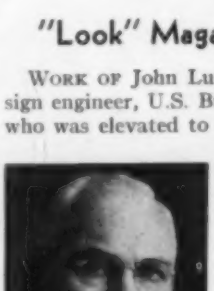
Edward J. Scripture, vice-president in charge of research for the Master Builders Co., was recently decorated with the French "Ordre des Palmes Academiques." A former colonel in the Army Corps of Engineers, with more than three years of service in the European Theater, Mr. Scripture received the award "for services rendered to science."

Charles E. Ryder has given up his consulting practice in Harrisburg, Pa., to join the staff of the Harrisburg engineering firm of Gannett, Fleming, Corddry & Carpenter, Inc. He will be chief of the water works and dam division.

La Vern J. Charles has retired as district engineer for the Public Roads Administration at St. Paul, Minn., after 42 years in government service.

"Look" Magazine Lauds Work of J. L. Savage, Hon. M. ASCE

WORK OF John Lucian Savage, chief design engineer, U.S. Bureau of Reclamation, who was elevated to Honorary Member of ASCE in 1941, is the subject of an article in the "*Look* Applauds" section of *Look* magazine in its issue released December 9.



J. L. Savage

Together with his picture, *Look* presented the following regarding Mr. Savage:

"More people are indebted to him, and will be for generations to come, than to any other engineer. Grand Coulee Dam, the world's biggest man-made structure, and some 60 other hydroelectric and irrigation projects have been built to his specifications. These projects have opened up millions of acres for farms, industries and homes.

"Savage is chief design engineer of the U.S. Reclamation Service. But the demand for his talents has been world wide. Recently he's been working on projects in Europe, Asia and Latin America. Yet never has he sought a fortune. His main interest is only to take part 'in enterprises that have as their objective the development of human relations.' "

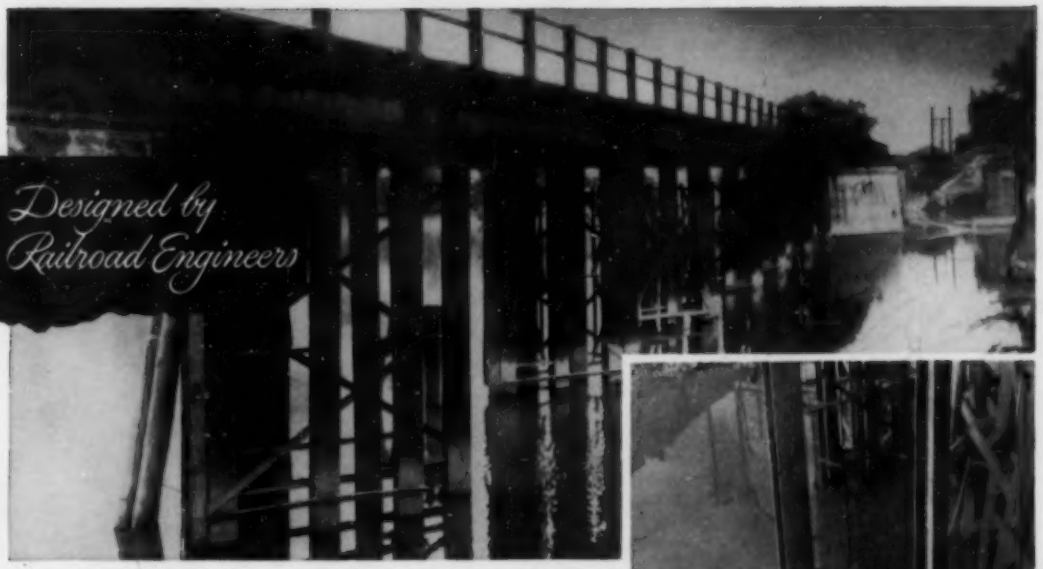
Ingenious New Hammer-Guide and Floating Template

plus U·S·S STEEL BEARING PILES

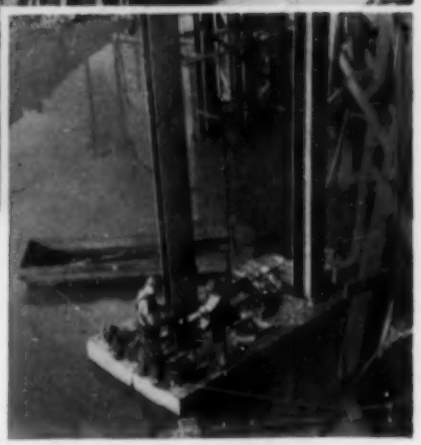
speed replacement of washed-out bridge!

Designed by Erie Railroad Engineers

...sembled about the body of ...e hammer and extending ap...roximately 12 ft. below base ... driving head, this ingenious ...vice will pick up, carry, spot ...gn hammer and drive steel ...aring piles.



General view of the steel pile trestle across the Chemung River, near Corning, N. Y. built to replace a washed out, three span, double-track bridge. Steel bearing piles were used when difficulty was encountered in getting timber piles started and in securing adequate penetration.



This floating template is composed of two halves which are unbolted and floated apart to free them from the driven pile bent, and then bolted together again at the location of the next row of piles.

When the Erie Railroad's double track bridge across the Chemung River, near Corning, N. Y. washed out during a flood in the Spring of 1946, only the most easterly of the three spans of the original bridge remained in place.

Following the usual emergency procedure, a single track timber pile trestle was driven in the opening created by the washed-out spans to permit two-way operation over the westward rails. However, because of the difficulty encountered in securing adequate penetration, and of getting the timber piles started in the rubble on the river bottom, the Railroad's engineers turned to U·S·S Steel Bearing Piles in rebuilding the south half of the bridge for the eastward track.

The design called for six-pile skewed bents, each with two lines of three piles each, with bents spaced on centers ranging from 30 ft. 9 in. to 36 ft. 3in. The design also called for prefabricated header beams for the bents and prefabricated vertical bracings between the piles, factors which required that the piles be driven true.

To facilitate driving, and to avoid interference with traffic on the westward track, the engineers developed a device which would pick up the steel piles from where they were set up near the end of the bridge, carry them to driving position, spot them in the specially designed floating template, and drive them with a steam hammer without conventional fixed or swinging leads, being supported only by the load line of the erecting crane.

That accurate driving was possible with the ingenious hammer-guide attachment and U·S·S Steel Bearing Piles, is seen in the fact that the template could be removed from many of the pile assemblies without binding. Also by the fact that prefabricated headers and vertical bracings of the bents were set in place and welded with only minimum adjustment of the tops of the piles.

The Erie's satisfactory experience further emphasizes the superiority of steel bearing piles in modern bridge construction. For detailed information on U·S·S Steel Bearing Piles, please contact the office nearest you.

PROVED STRUCTURALLY AND ECONOMICALLY SOUND

U·S·S STEEL BEARING PILES have proved their ability to provide a secure means of supporting foundations through unstable materials by their ability to go to firm strata at great depths. Their capacity for high unit loads, both vertical and horizontal, permits fewer piles and fewer driving operations for a given load. They are readily handled in the field by ordinary equipment. They are easy to splice. They eliminate jetting, and they withstand rough handling.

CARNEGIE-ILLINOIS STEEL CORPORATION
Pittsburgh and Chicago

USS STEEL — UNITED STATES STEEL

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
Tennessee Coal, Iron & Railroad Company, Birmingham, *Southern Distributors*
United States Steel Export Company, New York
8-143

UNITED STATES STEEL

Norman H. Collisson, former Navy captain, who served as Coal Mines Administrator during the federal operation of the bituminous mines, has returned temporarily to the Department of the Interior as special assistant to the Secretary. In this capacity, he will coordinate and direct the various activities of departmental agencies engaged in work on the Marshall Plan. Upon the liquidation of the Coal Mines Administration, Mr. Collisson had already taken an executive position with an Eastern industrial company when his services were again called for by the government. He was granted a leave of absence from the company to return to the Department of the Interior until all programs dealing with foreign relief problems are operating effectively.

N. H. Collisson

Burton L. Winslow is now superintendent of buildings and grounds at Bennington College, Bennington, Vt. Formerly town and village manager of Bennington, Mr. Winslow has more recently been serving as town manager of Brandon, Vt.

Sanford W. Sawin has retired as design and supervising engineer for the DuPont Co., Wilmington, Del., after 32 years of service with the organization. Mr. Sawin recently conducted special studies, following wartime work for the company as supervisor of Richland, Wash., village of the Hanford Engineer Works. Mr. Sawin is a former Director of the ASCE.

Walter A. Heimbuecher, for the past 34 years city engineer of University City, Mo., has been appointed director of public works.

Arthur H. Woolverton, until lately with the U.S. Bureau of Reclamation in Denver, Colo., has become chief hydraulic engineer for the Texas Board of Water Engineers, with headquarters at Austin.

William R. Bandy has been appointed regional cadastral engineer for Region III of the U.S. Bureau of Land Management, with headquarters at Helena, Mont. Mr. Bandy, who has been acting regional cadastral engineer for the past year, will be in charge of engineering and cadastral surveys in Region III which includes eight Western states.

Nathaniel C. Saxe, consulting engineer, has moved his office from Brooklyn, N.Y., to 122 East 42d St., New York City.

Theodore O. Reyhner has resigned as associate professor of civil engineering at the University of North Dakota to accept a similar position at the University of Oregon.

James B. Vernon recently retired from the Huntington, Ind., Board of Public Works after half a century of service for the City and County of Huntington. One of the oldest civil engineers in public service, Mr. Vernon's retirement followed the celebration of his 89th birthday.

Albert E. S. Hall, principal architect and civil engineer for the Du Pont Co., Wilmington, Del., has retired after almost 30 years in the service of the company. During the war, Mr. Hall served on the design and layout of war plants for the organization.

Deceased

Harold Wallace Baker (M. '27) city manager of Rochester, N.Y., from 1934 to 1941, was fatally stricken at the wheel of his car in Ithaca, N.Y., on November 8. He was 59. Mr. Baker had been in the Rochester Municipal Research Bureau, and in 1924 was appointed commissioner of public works, serving until 1932. He then became director of construction in the U.S. Engineer Department, Washington, D.C. A veteran of both World Wars, Mr. Baker recently served in the Navy Civil Engineer Corps in Washington. Since the war he had been chief of the safety department of the Eastman Kodak Co., at Rochester.

James Edwin Boatrite (M. '13) of Germantown, Pa., died recently at the age of 68. Early in his career Mr. Boatrite was resident engineer for the New York City firm of Levering & Garrigues on the construction of the New York terminal of the Brooklyn Bridge and other metropolitan structures. Beginning in 1904, he was for a number of years general manager of the Guerber Engineering Co., Bethlehem, Pa. More recently he had been assistant engineer in the Philadelphia Department of City Transit.

Asa Clair Butterworth (Assoc. M. '14) president of the General Material Co., St. Louis, Mo., died in that city on November 5, at the age of 67. In 1910, after early work in railroad engineering, Mr. Butterworth organized the Southern-Construction Co., Little Rock, Ark., which specialized in river protection and revetment work. Later he was a partner in the Miller-Butterworth Corp., of Little Rock, in general construction work. Moving to St. Louis in 1925, Mr. Butterworth established the General Material Co., manufacturers of ready-mixed concrete.

Orville Vosbury Derr (M. '39) engineer for L. Morris Mitchell, Inc., of New York City, died in Mount Vernon, N.Y., on November 23. He was 62. Beginning in 1912, Mr. Derr was for many years with the Erie Railroad—first as resident engineer in charge of double-tracking and grade revision of several districts. Later he was assistant vice-president in charge of valuation of the entire system. During the first World War, Mr. Derr served overseas in the Corps of Engineers.

Charles Job Eldridge (Assoc. M. '29) of Bloomfield, N.J., died on September 6, at the age of 61. Mr. Eldridge spent his early career on subway construction in New York City and on the construction of the Catskill Aqueduct. From 1922 until 1943 he was assistant engineer on the valuation of structures for the Erie Railroad Co. More recently Mr. Eldridge had been appraiser for the American Appraisal Co., Milwaukee, Wis.

Erik Theodore Eriksen (M. '23) retired engineer of Portland, Ore., died on October 13. Mr. Eriksen, who was 84, was with the U.S. Bureau of Reclamation for many years, retiring in 1933. He had also served as water master, under the U.S. District Court, of all irrigation in Stony Creek Basin, California. Mr. Eriksen was recently made a Life Member of the Society.

James Benton French (M. '98) retired consultant, died at his home in Jamaica, N.Y., on December 2, at the age of 84. From 1904 to 1908 Mr. French was bridge engineer for the Long Island Railroad, and later served the Chesapeake & Ohio and other railroads in a similar capacity. From 1908 until his retirement a few years ago, he maintained a consulting practice, specializing in the design and construction of bridge structures for several railroads. He held patents on the design of electrically operated car float transfer bridges in use at several railroad terminals in New York Harbor. Mr. French was one of four surviving ASCE members who attended the Paris Exposition of 1889.

Philip Winthrop Ham (Assoc. M. '15) of Auburn, N.Y., died on November 29, at the age of 60. Mr. Ham was structural steel draftsman for the New York engineering firm of Post & McCord from 1910 to 1912, and resident engineer and chief engineer for the Great Western Power Co., of San Francisco, from 1912 to 1922. From the latter year until 1942 he was secretary and treasurer of the Auburn Iron Co., and more recently had been general foreman of the Columbian Rope Co., at Auburn.

Philip Walter Henry (M. '08) New York City consultant and vice-president and secretary of the American Institute of Consulting Engineers, died in a hospital in New York on November 7. He was 81. Mr. Henry was with the Barber Asphalt Co. from 1887 to 1902, becoming vice-president and general manager. He planned and constructed the Central Railroad of Haiti, of which he was president from 1903 to 1917. He was vice-president of the American International Corp. from 1916 to 1923, and of the Siems-Carey Railway and Canal Co. from 1921 to 1923. Since 1924 he had been secretary of the American Institute of Consulting Engineers. Mr. Henry was the author of numerous articles on highway engineering and other subjects, and had served as American delegate to several meetings of the International Congress of Road Builders.

Philip W. Henry

Alfred Chapin Gallagher (Assoc. M. '31) superintendent of the Turner Construction Co., New York City, died suddenly on Sep-

tember 13. He was 55. Mr. Gallagher had been with the Turner Construction Co. since 1916, except for a two-year period of service in the Army Field Artillery during the first World War. He was superintendent in charge of building operations from 1922 on.

John George Hirsch (Assoc. M. '15) mechanical superintendent for the St. Joseph Lead Co., Bonne Terre, Mo., died there on November 9. Mr. Hirsch, who was 61, had been with the St. Joseph Lead Co. for the past 23 years. Before that he had been in the consulting office of Daniel W. Mead, Madison, Wis.; with the Stone & Webster Engineering Corp., Boston; and the Benham Engineering Co., Kansas City, Mo.

Andrew Kinghorn Johnson (M. '27) former Queens highway engineer, died at his home in St. Albans, Queens, on November 24, at the age of 65. Mr. Johnson retired in June 1946, after 40 years in the service of New York City. He was engaged on the construction of the Catskill Aqueduct from 1906 to 1914, and since the latter date had been in the Queens Highway Department—as chief engineer from 1928 until his retirement. Mr. Johnson was a past-president of the National Society of Professional Engineers and of the New York Society of Municipal Engineers.

John Knickerbacker (M. '00) of Troy, N.Y., died on June 16, 1947, though word of his death has just reached the Society. Mr. Knickerbacker, who was 81, spent his entire career with the Eddy Valve Co., of Waterford, N.Y. He was vice-president from 1887 to 1889, and since the latter date had been president.

Jonta Boen Marcellus (M. '21) former city engineer of Claremont, Calif., died at his home at Pomona, Calif., on November 13. Mr. Marcellus, who was 65, had been chief engineer for E. W. Marland, of Ponca City, Okla., and for 15 years was engineer-appraiser for the Federal Land Bank of Wichita, Kans. More recently he had represented the Kansas City engineering firm of Black & Veatch in California and had been city engineer of Claremont.

Charles Adam Mixer (M. '93) retired engineer of Rumford, Me., died on October 24. Mr. Mixer had spent most of his career with the Rumford Falls Power Co., having gone there as engineer many years ago. Later he became chief engineer, and for several years prior to his retirement in 1944 served the organization in the capacity of consulting engineer.

Archibald Whitfield Nance (Assoc. M. '17) of Pittsburgh, Pa., died suddenly at his home there on November 7. He was 60. A specialist in bridge design, Mr. Nance was a member of the Farris Engineering Co., of Pittsburgh, from 1910 until his retirement in 1940. Since the latter year he had been the engineer member of the Pennsylvania State Board of Health. He was prominent in Masonic activities, and a veteran of World War I.

Walter Samuel Olson (M. '40) director of the Division of Water Resources and Engineering of the Minnesota Department of Conservation, St. Paul, Minn., died in that city on October 15. Mr. Olson, who was 57, had been in the service of the state for more than 30 years.

Harry Nelson Pharr (M. '05) civil engineer and member of the Mississippi River Commission, Memphis, Tenn., died in Memphis on November 3, at the age of 72.

Harry N. Pharr

An authority on flood control of the Mississippi River and its tributaries, Mr. Pharr served as chief engineer of the St. Francis Levee District of Arkansas from 1897 to 1907 and, again, from 1918 to 1935. At one time he was also chief engineer of the Crawford County Levee District of Arkansas. He had been a member of the Mississippi River Commission since 1935.

Arthur Graham Robbins (Affiliate '16) retired engineer of Winchester, Mass., died on October 26. Mr. Robbins, who was 85, was on the teaching staff of the Massachusetts Institute of Technology from the time of his graduation there, in 1886, until 1932. He retired in the latter year, with the rank of professor emeritus.

Naum Levi Shamroy (Assoc. M. '30) of Pittsburgh, Pa., died on October 11, at the age of 48. Mr. Shamroy had been with the late George F. Hardy, M. ASCE, of New York, on the design and construction of paper mills; designing draftsman for the Masonite Corp., at Laurel, Miss.; and chief draftsman for H. S. Ferguson & Co., of New York. More recently he was connected with the Rust Engineering Co., of Pittsburgh.

George Eber Stratton (M. '12) chief of the Construction Section of the U.S. Civil Aeronautics Administration, Washington, D.C., died there on November 8. His age was 74. Mr. Stratton had been an engineer for the Metropolitan Sewer Commission of Boston, Mass., and the War Department, and from 1903 to 1926 was in the U.S. Bureau of Reclamation. In 1927 he joined the U.S. Bureau of Air Commerce (now the Civil Aeronautics Administration) as engineer, later becoming chief of the Construction Section.

Edward Heer Stumpf (Assoc. M. '31) of Pittsburgh, Pa., died suddenly at his home there on November 25. Mr. Stumpf, who was 49, had been on the engineering staff of the City of Pittsburgh, in charge of surveys for street and sewer contruction. Later he was contract engineer for the Pennsylvania Department of Highways and district engineer and assistant chief engineer of the Eastern Region of the National Paving Brick Association, in charge of promotional work. During the recent war, Mr. Stumpf served as a lieutenant commander in the Navy.

Edward Ernest Russell Tratman (Assoc. M. '91) civil engineer of Wheaton, Ill., died on November 30, at the age of 84. Born and educated in England, Mr. Tratman came to the United States in 1884, later serving as special government agent to report on metal and wood railway ties. Author of many works on railroad engineering subjects, he received the Society's Norman Medal in 1888 for a paper on English railway track. From 1886 to 1932 he was on the editorial staff of the *Engineering News-Record*. Mr. Tratman was fourth on the list of veteran Society members, having joined the ASCE as a Junior in 1886.

Minton Machado Warren (M. '20) construction engineer of Cambridge, Mass., died in New York City on November 4. Mr. Warren had been with Stone & Webster, of Boston, on a wide variety of construction work in this country and Cuba. While serving overseas in the first World War, he organized the first American Topographic Section and, after the armistice, was in charge of the repair and reconstruction of 500 miles of French roads. Later Mr. Warren organized and directed several aircraft corporations, and more recently he was director of research for Jackson & Curtis, of New York City.

Grass Stabilizes Sand at New York's Idlewild Airport

(*Continued from page 35*)

Experience with both these seashore grasses shows that beach grass is more readily adapted to machine planting methods since the plants contain less trash and therefore pass through the machine without serious clogging, thus making it unnecessary to sacrifice the upper portion of the plant. An area planted with beach grass with the specified number of plants per acre results in raising the level of the wind to the tips of the mass of grass, about 18 in., thereby practically eliminating the shifting of sand.

Poverty grass plants, on the other hand, contain more trash, and must be cleaned more thoroughly. Also the stems are brittle and must be chopped off to about 8 in. above the ground before they will pass through the machine. As a result the planting of poverty grass alone will not deflect the wind high enough above the ground surface to prevent the shifting of sand.

Poverty grass seeds readily, and in this manner tends to spread rapidly over an area. Beach grass, however, very rarely produces viable seed. The planting of a combination of not over 10 percent of poverty grass with 90 percent of beach grass will produce a more satisfactory and rapid permanent cover than a planting of beach grass exclusively. It is this combination method which is being followed at New York International Airport.

This extensive program of sand stabilization has progressed with the advice of specialists of the Long Island State Park Commission who

have gained experience in this work over many years in the development, reclamation and stabilization of the Long Island beaches. Contracts at New York Airport have been completed covering 3,200 acres of beach grass planting. Bids under various contracts ranged from $125 to $210 per acre.

It should be observed that until all construction work at New York International Airport is completed, there is bound to be some blowing sand from open excavations, grading operations and other soil disturbances. The only remedy is constant and continuous planting and replanting. Complete success can be expected, however, only when the last construction operation has been finished.

Deep Caisson Piers Support New Memphis Highway Bridge

(*Continued from page 25*)

to concrete anchors weighing 40 to 50 tons each.

Preparation of the site for sinking the two deep-water piers included dredging and the placing of a 250× 300 ft willow mat over the mud river bottom. Pouring of concrete in the steel caissons forced the cutting edges of the caissons through the wood mat and rock riprap with which the mat was sunk, aided by a specially-built cutting tool plunged along side of the caisson. When the caissons had been sunk to refusal by open dredging, operations were continued by pneumatic methods. Air pressures as high as 45 lb were required.

The smaller reinforced concrete Arkansas approach piers are founded on concrete piles as is the Memphis abutment. Merritt-Chapman & Scott, New York contractors who built the seven main piers, are also constructing the Arkansas approach structure. Harris Structural Steel Co. of New York has been awarded the contract for the main bridge superstructure.

Uruguay's Rincon del Bonete Project Supplies Hydro Power

(*Continued from page 30*)

units, the use of critical materials was decreased to 60 percent. In preference to 6.6 kv and three-winding transformers as specified by the Germans, a generating voltage of 13.8 kv and two-winding transformers were chosen. Local service is to be obtained by stepping down from the 13.8-kv bus instead of from the extra transformer winding. Protection of the transmission line is accomplished by double overhead ground wires and by additional use of shielding wires on substation structures. Lightning arresters are mounted on the transformers for maximum protection. Two 20,000-kva, synchronous condensers will be installed at the north substation. These synchronous condensers will be supplied by Allis-Chalmers Manufacturing Co., Milwaukee, Wis.

Hydro power at the steam-plant substation is synchronized with the steam plants which are rated at 90,000 kw. For the past four years this rating has been greatly reduced through the deterioration of equipment caused by the unavoidable and prolonged use of poor fuels, such as sunflower seed, corn, and Brazilian coal(with 30 percent or more ash); because of the impossibility of taking equipment out of service for a sufficient length of time to perform needed repairs, before the hydro plant was in operation; and because of the lack of spare parts.

The machinery and equipment for the third and fourth hydro units, the second transmission line and associated substation equipment, are now being installed. Part of the machinery and equipment is still under construction in the United States. The first hydro unit has been in operation since December 21, 1945, and the second one since February 1947. The third unit will be in operation in March 1948, and the fourth will be ready at the end of 1948. The whole system, including all the Montevideo substations and the synchronous condensers, will be finished at the beginning of 1950.

Arch Roof Construction Provides Column-Free Area

(*Continued from page 31*)

porting structure. The shell reinforcing consists primarily of two layers of welded wire mesh with additional reinforcing placed at critical points. To obtain maximum efficiency in the use of both labor and falsework, high early strength cement, poured in a continuous operation, was used for the main and small roofs on each side.

Falsework provided with wheels and mounted on rails was built for one unit. When sufficient time had elapsed after making a pour, the falsework was lowered an inch or two by means of screw jacks and rolled into position for succeeding adjacent units. Expansion joint material was placed between adjacent units and metal flashing was placed over the joint to render it weatherproof.

Designed by the Bureau of Architecture of New York City, Department of Public Works (at that time under the direction of A. Gordon Lorimer and now under A. J. Dingdone), the building was erected by the Corbetta Construction Co. of New York City. Roberts and Schaefer Co. of Chicago served as engineers.

Rock Riprap Slope Protection at Santee-Cooper Project

(*Continued from page 18*)

The work involves the breaking up of 400,000 sq yd of porous concrete and quarrying, transporting and placing 330,000 cu yd of solid rock. Porous concrete is being broken by a specially designed pavement breaker mounted on a truck chassis, operated by compressed air both above and below water, as shown in accompanying photographs. Rock is being quarried near the Congaree River above the headwaters of the Santee Reservoir, transported by barges and LCT's to the site, where placement is by clamshell cranes mounted on barges.

Recent inspection of the condition of the porous concrete has confirmed the opinion that a wise decision was made when rock riprap on a rock filter layer was selected as the final slope-protection material.

Harza Engineering Co. was consulting engineer for the entire project for the South Carolina Public Service Authority, while Malcolm Pirnie, Past-President ASCE, served in a similar capacity for the Federal Works Agency for the new slope-protection project. J. H. Moore is chief engineer for the Authority. C. L. Vickers is project engineer for the Federal Works Agency. E. R. de Luccia, M. ASCE, and W. R. Farley, Assoc. M. ASCE, represented the Federal Power Commission with H. W. Steele, Assoc. M. ASCE, as consultant for the Corps of Engineers. The Board of Consulting Engineers was composed of W. H. McAlpine, Andrew Weiss, R. R. Proctor and S. O. Harper, Members ASCE.

Investigation of the slope-protection damage was initiated in 1944 by Col. William N. Carey, now Executive Secretary, ASCE, then chief engineer, Federal Works Agency. The writer has been connected with the supervision of the project for the Office of the Administrator and for the Bureau of Community Facilities, Federal Works Agency, since 1944.

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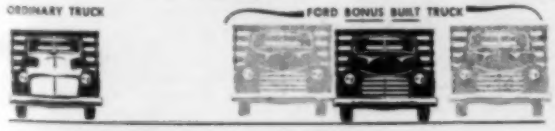

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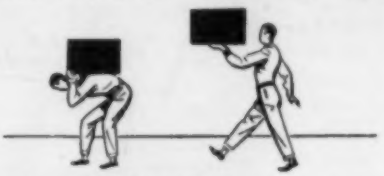

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AIR CONDITIONING. By Herbert Herkimer and Harold Herkimer. Chemical Publishing Co., Brooklyn, N.Y. (26 Court Street), 1947. 720 pp., illus., tables, diagrs., charts, 8½×5½ in., cloth, $12. A useful book for engineers and others engaged in the expanding field of air conditioning. The object of the book is to provide all the required information on every phase of the subject—estimation, sales, production, installation, supervision, service, etc. It reviews the laws of chemistry and physics involved in air conditioning, and then goes on to the practical aspects of the industry.

CALIFORNIA GOLD, THE BEGINNING OF MINING IN THE FAR WEST. By R. W. Paul. Harvard University Press, Cambridge, Mass., 1947. 380 pp., illus., tables, 8¾×5¼ in., cloth, $4.50. The beginning of mining in the Far West is described in this study of the period between Marshall's discovery of gold in 1848 and 1873. Well documented, the book covers not only the cycles of boom and decline in the gold fields but also the story of the economic and financial activities which provided the foundation for the development of the West. The work and life of the ordinary gold miner are described, including contemporary illustrations.

EXPOSITION, TECHNICAL AND POPULAR, edited by J. R. Gould and S. P. Olmsted. Longmans, Green and Co., New York, London, Toronto, 1947. 126 pp., diagrs., tables, 8¼×5½ in., cloth, $1.75. Using the term "exposition" to mean the type of writing of which the basic function is to inform, this book describes writing techniques for the man with a technical background as well as for the general reader. The material is presented in three sections. The first analyzes the various types of exposition and includes models extending from the simple to the complex, and from the technical to the popular. The research article is handled in section two. Attention is directed to methods of research, systems of note taking, and the preparation of footnotes and bibliography. The third section shows the devices which may be used in the adaptation of specialized material for the lay audience.

GLACIAL GEOLOGY AND THE PLEISTOCENE EPOCH. By R. F. Flint. John Wiley & Sons, New York; Chapman & Hall, London, 1947. 589 pp., illus., diagrs., maps, tables, 9¼×5¾ in., cloth, $6. This book presents a compact reconstruction of the history of the Glacial epoch for geologists, ecologists, archeologists, geographers and others interested in the prehistoric realm. Giving a wealth of detailed descriptive material, it constitutes a reference to data already compiled and indicates the areas in which further research is needed. Correlations of Pleistocene strata, and other broad general conclusions based on geologic evidence are presented. Some 800 literature references are listed covering a wide range, but important titles from various countries during the war years may be lacking.

INDUSTRIAL MANAGEMENT, 4 ed. By W. R. Spriegel and R. H. Lansburgh. John Wiley & Sons, New York; Chapman & Hall, London, 1947. 656 pp., illus., diagrs., charts, tables, 9¼×5¾ in., cloth, $5. Policies and principles of successful management are presented, with the devices necessary for carrying them out, keeping in mind the needs both of the college student and the executive. Throughout the book an effort has been made to show the interdependence of the various major departments of a business. The fourth edition has been thoroughly revised to cover the recent developments in the field, and includes as new material a chapter on maintenance. There is a broadly classified bibliography.

SPECIFICATIONS FOR STEEL RAILWAY BRIDGES FOR FIXED SPANS NOT EXCEEDING 400 FT IN LENGTH. American Railway Engineering Association, 59 East Van Buren St., Chicago 5, Ill., 1947. 6 pp., diagrs., tables, 9×6 in., paper, $0.50. The specifications are for steel railway bridges with fixed spans not exceeding 400 ft in length. Parts I, giving details of design and manufacture, includes proposals, drawings and weighing and shipping information. Parts II and III cover the various types of steel for structural and rivet use, giving chemical and physical properties and certain information concerning alloy steels as appropriate as specification clauses.

WATKINS CYCLOPEDIA OF THE STEEL INDUSTRY, 3 ed. Steel Publications, Inc., Pittsburgh (1 Smithfield St.), 1947. 375 pp., plus 93 pp. directory and advertisers' index, illus., diagrs., tables, 11⅛ × 8¼ in., cloth, $10. This book describes briefly modern procedures required for performing operations employed in the manufacture of steel from the treating of iron ores to the handling of the finished product. Such processes as beneficiation, nodulizing, and sintering are discussed. The blast furnace, the open hearth furnace, the bessemer converter, the electric furnace, and the cupola are dealt with. Rolling and shaping of steel, forging and welding of steel, metal finishing and cleaning, and the inspection and testing of steel are mentioned.

WIND-TUNNEL TESTING. By A. Pope. John Wiley & Sons, New York; Chapman & Hall, London, 1947. 319 pp., illus., diagrs., charts, tables, 8½×5½ in., cloth, $5. This volume presents an analysis and study of the extensive but scattered technical information published on the subject. The topics covered are design and general consideration of tunnels, testing procedures with scale-model aircraft, extrapolation to full size and wind-tunnel-boundary corrections. The design of a propeller-flow straightener system is treated. An appendix discusses the construction of a wind-tunnel model. A list of references is given at the end of each chapter.

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APPLICATIONS FOR ADMISSION OR TRANSFER

January 1, 1948 — Number 1

The Constitution provides that the Board of Direction shall elect or reject all applicants for admission or for transfer. In order to determine justly the eligibility of each candidate, the Board must depend largely upon the membership for information.

Every Member is urged, therefore, to scan carefully the list of candidates published each month in CIVIL ENGINEERING *and to furnish the Board with data which may aid it in determining the eligibility of any applicant.*

It is especially urged that a definite recommendation as to the proper grading be given in each case, inasmuch as the grading must be based upon the opinions of those who know the applicant personally as well as upon the nature and extent of his professional experience. Any facts derogatory to the personal character or professional reputation of an applicant should be promptly communicated to the Board. Communications relating to applicants are considered strictly confidential.

The Board of Direction will not consider the applications herein contained from residents of North America until the expiration of 60 days, and from non-residents of North America until the expiration of 90 days from the date of this list.

MINIMUM REQUIREMENTS FOR ADMISSION

GRADE	GENERAL REQUIREMENT	AGE	LENGTH OF ACTIVE PRACTICE	RESPONSIBLE CHARGE OF WORK
Member	Qualified to design as well as to direct important work	35 years	12 years	5 years
Associate Member	Qualified to direct work	27 years	8 years	1 year
Junior	Qualified for subprofessional work	20 years	4 years	
Affiliate	Qualified by scientific acquirements or practical experience to cooperate with engineers	35 years	12 years	5 years

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WHIDDEN, FRANCIS EUGENE (Age 31) With Structural Eng. Dept., Libby-Owens-Ford Co., Toledo, Ohio.

ALA. POL. INST.

Age

WADE, GERALD WEAR, 1947 (20)

BROOKLYN POL. INST.

SHERWANI, ABDUL JABBER, 1947 (24)

CARNEGIE INST. TECH.

DANIELS, STUART RUSSELL, 1947 (21)
MCDERMOTT, JOHN FRANCIS, 1947 (21)
PYZDROWSKI, HENRY ANTHONY, 1947 (25)
SAUK, FRANK ANTHONY, 1947 (20)

COLL. OF CITY OF N.Y.

KANE, HARRISON, 1947 (22)

GA. SCHOOL TECH.

SOMERS, WILLIAM COITE, JR., 1947 (23)

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BEDFORD, JOHN GLENNON, 1947 (21)
HALSEY, JAMES FREDERIC, 1947 (21)
KIMBROUGH, MAURICE LEROY, 1947 (23)
RASTRELLI, LEONARD U., 1947 (25)
ROBINSON, BERNARD LEO, 1947 (23)
SLINKMAN, GEORGIA EVELYN, 1947 (23)

IOWA STATE COLL.

GAGNON, CLARE JOSEPH, 1947 (20)
PRIDE, RICHARD ALLEN, 1947 (20)

JOHNS HOPKINS UNIV.

PASS, RALPH PATRICK, JR., 1947 (22)

MANHATTAN COLL.

VALENZIANO, FRANK PHILIP, 1945 (22)

UNIV. OF MINN.

MILLER, RALPH EDWARD, JR., 1947 (24)

NORTHWESTERN TECH. INST.

BRADAKIS, HENRY LEON, 1947 (20)

UNIV. OF NOTRE DAME

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UNIV. OF TENN.

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BLUMER, HOWARD DILLMAN, 1947 (20)

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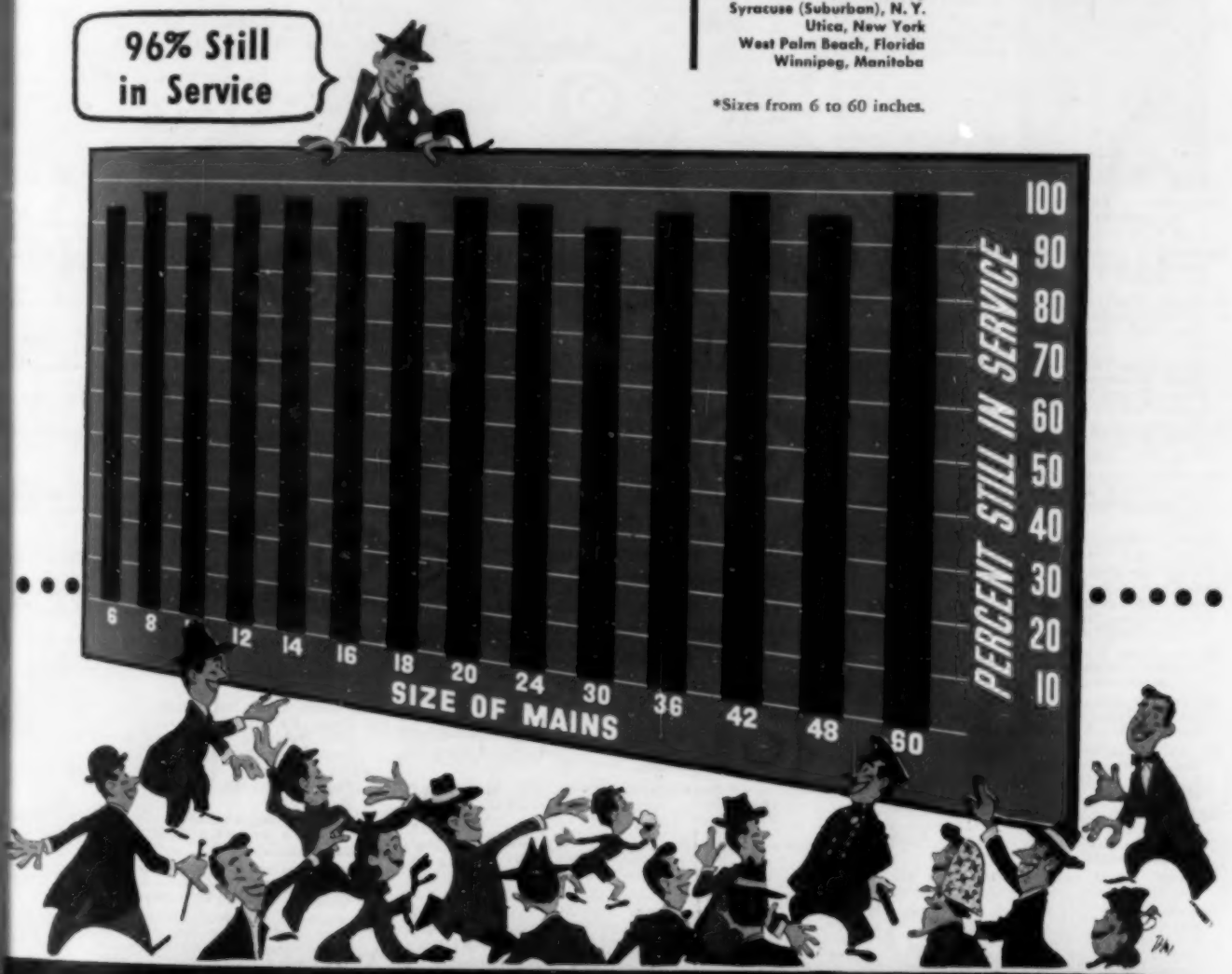

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(From November 10 to December 9, 1947)

Additions to Membership

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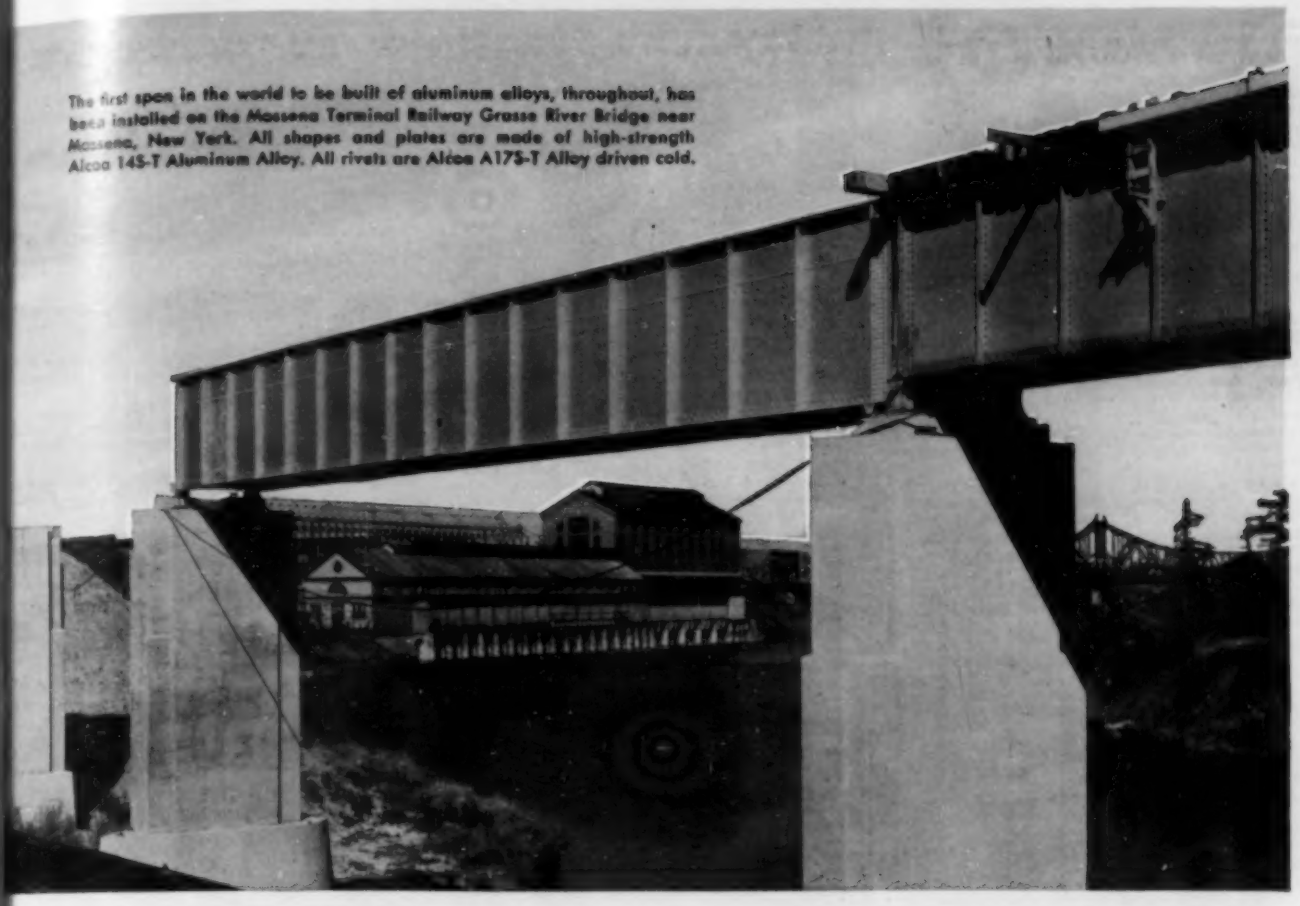

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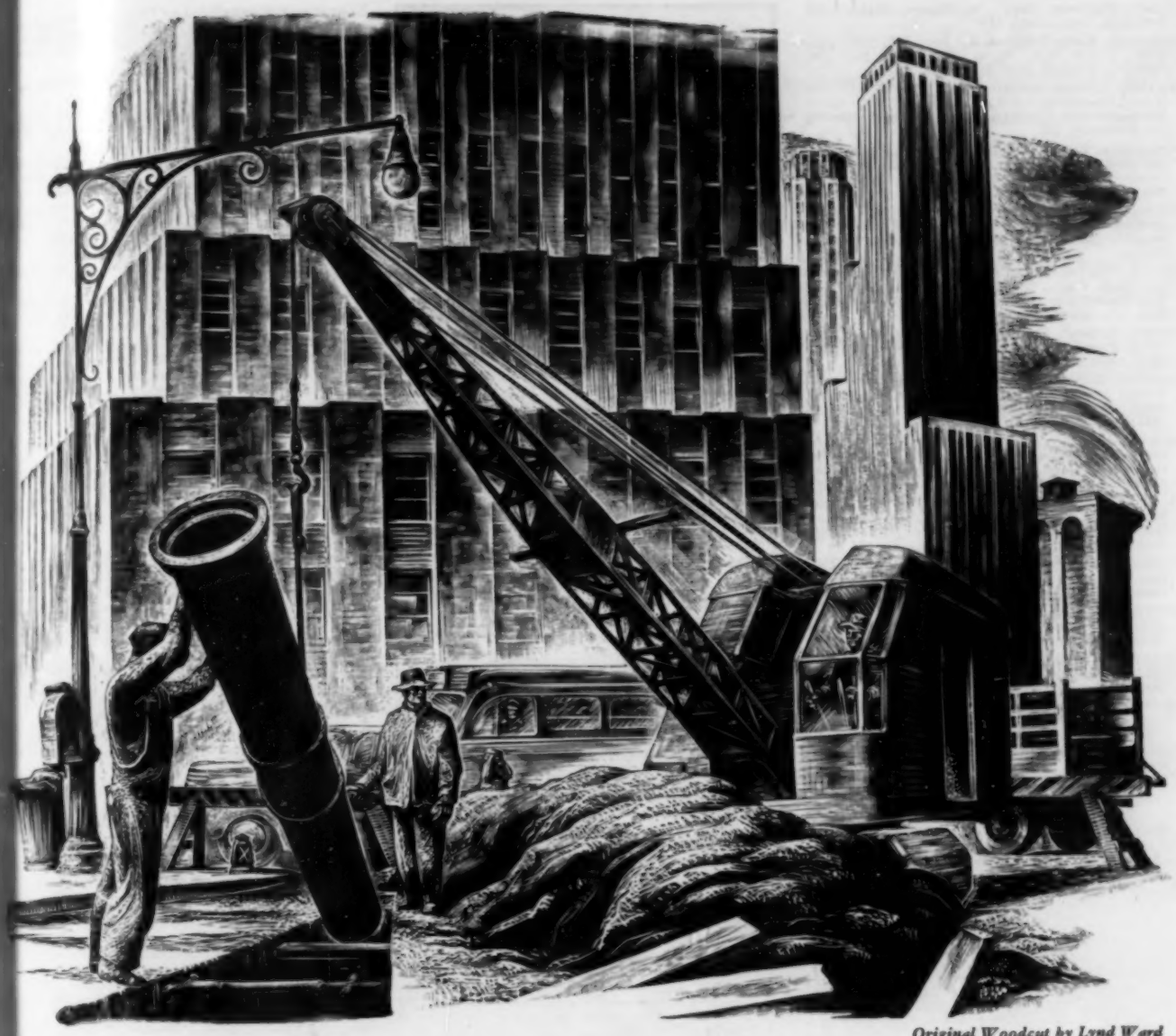

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SANITARY ENGINEER; Jun. ASCE; 24; married; recent graduate interested in working in sanitary engineering field and general construction. Nearly 2 years experience in construction. Location preferred, New York City or nearby states. C-401.

TEACHING AND ADMINISTRATIVE ENGINEER; Assoc. M. ASCE; age 45; desires to make a connection with a major university or consulting engineering firm looking toward (1) a professorship in civil engineering or head of department for 1948–1949 school year or (2) position or possible partnership in general engineering field especially hydraulics, hydroelectric power, and hydrology. Master of science degree in civil engineering, major transportation engineering and economics and minor in general public utility economics and public and private finance. Now engaged as engineering consultant in a government foreign mission of economics and economic development. Can be available February 1, but present tenure assured until July 1, 1948. Experienced in teaching, construction, design and administration. Commander, CEC, USNR, 5 years' active duty last war. C-402.

Positions Available

CIVIL ENGINEERS. (*a*) Construction Engineers with experience in construction of petroleum refineries and qualified to take responsible charge of large refinery construction projects. Apply by letter stating education, qualifications, experience, salary requirements and date available. (*b*) Construction Engineers with experience in construction of petroleum refineries. Apply by letter stating education, qualifications, experience, salary requirements and date available. W-9635.

STRUCTURAL ENGINEER experienced in the design of steel and reinforced concrete buildings and structures for industrial, sewage and water treatment plant. Excellent opportunity for well-qualified man in Consulting Engineer's office. Write stating qualifications, experience, salary requirements and date available. Location, Ohio. W-9932D.

This placement service is available to members of the Four Founder Societies. If placed as a result of these listings, the applicant agrees to pay a fee at rates listed by the service. These rates—established to maintain an efficient non-profit personnel service—are available upon request. The same rule for payment of fees applies to registrants who advertise in these columns. All replies should be addressed to the key numbers indicated and mailed to the New York Office. Please enclose six cents in postage to cover cost of mailing and return of application.

TEACHING PERSONNEL. (*a*) Instructor of building construction technology. Experience should include both heavy and light construction, drafting experience, surveying or knowledge of construction materials and equipment. Salary, $4,130 a year. Location, Westchester County, New York. W-9961.

ENGINEER, civil or mining, recent graduate, with some field experience, to do surveying and field engineering on dredging project. Salary, $2,400–$2,700 a year plus room and board. Location, Colombia. W-9997.

CIVIL ENGINEER, graduate, 26–28, single, for technical service work for cement manufacturer. Will contact customers and assist with any problems arising. Company will train. Several locations available, all out of New York City. Y-23.

INSTRUCTOR OR ASSISTANT PROFESSOR of civil engineering and mechanics. Position starts March 1948. Write giving references, experience, and salary expected. Location, Upstate New York. Y-52.

ENGINEERS, 21–40. (*a*) Steel and concrete detailers, young; structural designers; estimators; architectural draftsmen. Some of these positions will lead to field supervision duties. (*b*) Chief Draftsman with architectural and engineering background. Apply by letter stating education, experience, salary requirements and date available. Location, Southwest. Y-55.

CIVIL ENGINEERS, young with some construction or office experience, for big contracting firm. Salary, about $4,800 a year. Location, West Virginia. Y-57.

ENGINEER, civil or mechanical graduate, young, with water works experience, for field hydraulic surveys of municipal water works. Considerable traveling, with various headquarters in United States. Salary, $4,000–$5,000 a year. Y-60.

ASSISTANT PROFESSOR, with master's degree or equivalent experience or Associate Professor with master's degree plus considerable experience, to teach surveying, mechanics, strength of materials, water supply and sanitary engineering. Salary, $2,600–$3,400. Location, Vermont. Y-72.

ASSISTANT ENGINEER, under 45, degree in civil or mechanical engineering preferred, with 2 years' experience in building, construction, designing, machinery, refrigeration, etc. Professional Engineer's certificate in New York State helpful. Considerable amount of drafting. Should have ability to write orders, specifications, etc. Must pass a rigid medical examination. Salary, $3,600 a year. Resident of Metropolitan New York. Location, New York Metropolitan Area. Y-73.

CIVIL OR ARCHITECTURAL ENGINEER, 22-28, graduate, to design service stations, warehouses, office buildings and other small buildings. Make hydraulic calculations and design pumping and pipeline installations. Write contracts, specifications and requisitions for materials. Estimate costs on all construction jobs; handle office correspondence relating to requisitions; make economic studies of bulk plant design and location; supervise and layout miscellaneous small construction jobs at bulk plants. Will be required to train Nationals. Will be required to learn Spanish. Single status for 30 days. Salary $5,640–$7,320 a year. Location, Venezuela. Y-86.

CONSTRUCTION SUPERINTENDENT, not over 45, chemical or civil graduate, with some experience in the construction of chemical plants. Temporary location, Pennsylvania. Later retained as general maintenance and construction engineer with headquarters in New York, N.Y. Y-87.

ENGINEERS, under 45, preferably with rural experience, interested in working as consultant independently or with a group and adaptable to local conditions in India. (*a*) Watershed Planner with hydroelectric and irrigation experience to plan projects, industries, relocation of people, soil conservation and agricultural development. (*b*) Architectural or Civil Engineer with building material and construction experience to improve village living and economic conditions. (*c*) Agricultural Engineer with research and equipment experience to improve agricultural implements, animal powered equipment and irrigation work. (*d*) Agricultural Supervisor and Rural Planner, preferably with county agent or cooperative experience to demonstrate improved methods of farming, soil conservation, afforestation, animal husbandry and generally improved sanitary and living conditions. (*e*) Village Planner with city or village planning and housing experience, to plan redevelopment of existing communities with regard to housing, sanitation, water supply and general municipal facilities. Positions start about May 1, 1948. Salary $7,500–$10,000 a year with transportation, one month annual leave. Three-year government contract. Location, India. Y-111.

SUPERINTENDENT OF CONSTRUCTION, with minimum of 5 to 10 years' experience on road construction. Must report single status. Salary $8,400 a year. Location, New Guiana. Y-115.

ENGINEERS. (*a*) Assistant Chief Engineer, under 50, civil, with experience in soil mechanics and foundation work for piers and abutments for railroad bridges. Salary, $10,400 a year. (*b*) Bridge Designer with experience in a state highway department desirable. Salary, $8,000 a year. (*c*) Tunnel Designer, with experience in the design and timbering of railroad and highway tunnels. Salary, $8,000 a year. (*d*) Superintendent of Construction with experience in soft ground tunnel work. Salary, $8,000 a year. (*e*) Area Manager, civil engineer with minimum of 2 years background in general construction to coordinate various field jobs. Salary, $12,000 a year. Subsistence and quarters furnished for $1.25 a day. Location, Greece. Y-116.

(*Continued from page 94*)

TIMMONS, CARL WELLS (Jun. '47) Engr. Estimator, Bank of America, 300 Montgomery St. (Res., 529 Duboce Ave.), San Francisco, Calif.

TOM, FAY SUE (Jun. '47) Buyer, Chong Kee Jan Co., 957 Grant Ave. (Res., 742 Jackson St.), San Francisco, Calif.

TROIANO, ROBERT CHARLES (Jun. '47) Junior Engr., The M. W. Kellogg Co., 225 Broadway (Res., 110 Terrace View Ave.), New York, N.Y.

TUPTS, EDWARD E. (Assoc. M. '47) Design Engr., Eng. Dept., City Hall, Phoenix, Ariz.

VAN EYCK, MARVIN ROWAN (Jun. '47) Civ. Engr., Milwaukee County Highway Dept., Court House (Res., 535 North 11th St.), Milwaukee, Wis.

VAN ORMAN, STANLEY HOWARD (Jun. '47) Graduate Student, Utah State Agr. College (Res., 245 East 3d North), Logan, Utah.

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VERNER, ROBERT JOSEPH, JR. (Jun. '47) Civ. Engr., Fruin-Colon Cont. Co., 1706 Olive St. (Res., 5207A Kensington), St. Louis 8, Mo.

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WADDELL, JAMES MADISON, JR. (Jun. '47) Junior Engr., Thompson O. Street, Gen. Contr., U.S. Naval Hospital, Beaufort (Res., Port Royal), S.C.

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WAH, THEIN (Jun. '47) Student, Univ. of Utah, Civ. Eng. Dept. (Res., 1382 Perry Ave.), Salt Lake City, Utah.

WARNOCK, THOMAS HENRY (Jun. '47) Field Engr., Texas Petroleum Co., Apartado 267, Caracas, Venezuela.

WARREN, JOSEPH TURNER (Jun. '47) Eng. Trainee, State Highway Dept. (Res., Box 102, Route 1), Fairfax, Va.

WASHBURN, HARVEY CURTIS (Jun. '47) Engr., Peter Kiewit Sons Co., Box 491, Longview, Wash.

WEBER, GEORGE HENRY (Jun. '47) Engr., Standard Oil Co. of Calif., P.O. Box 950 (Res., 715 North East Aimsworth Ave.), Portland, Ore.

WENZEL, ROBERT CARL (Jun. '47) Senior Draftsman, Carbide and Carbon Chemicals Corp., P. O. Box P, Oak Ridge, Tenn. (Res., 2501 Jefferson St., Paducah, Ky.)

WHETSTONE, GEORGE ARTHUR (Assoc. M. '47) Asst. Prof. Civ. Eng., Texas Technological College, Lubbock, Tex.

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WHITE, JOHN RICHARD (Jun. '47) Concrete Contr. (W. L. White & Son), 1438 Harding Ave. (Res., 2114 North 7th St.), Terre Haute, Ind.

WHITE, SAMUEL JENNINGS (Assoc. M. '47) Chf. Engr., Public Works Dept., U.S.N. Submarine Base, Rodman, C.Z.

WHITEHURST, ELDRIDGE AUGUSTUS (Jun. '47) Asst. Research Engr., Portland Cement Assn., 33 West Grand Ave., Chicago 10, Ill.

WHITSETT, JAMES JACOB (Jun. '47) Structural Engr., The Austin Co., 16112 Euclid Ave., Cleveland, Ohio.

WILCOX, JAMES RUFUS (Jun. '47) City Engr., Town of Fairbanks, Box 1540, Fairbanks (Res., Box 938, College), Alaska.

WILSON, HARRY DENNIS, JR. (Jun. '47) Hydr. Engr., U.S. Geological Survey, P.O. Bldg., Room 226, Jamaica (Res., 462 Decatur St., Brooklyn 33), N.Y.

YARBROUGH, FREDERICK WILLIAM (Jun. '47) Civ. Engr., Eugene Water Board, 1160 South Willamette (Res., 3141 South Willamette), Eugene, Ore.

YARROW, JOSEPH RICHARD (M. '47) Chf. Engr., Airways Eng. Consultants, Inc., 1212 Eighteenth St., N.W., Washington 6, D.C.

YASKO, KAREL HENRY (Assoc. M. '47) (Foster & Yasko, Archts.), 407 Scott St., Wausau, Wis.

Membership Transfers

ALLEN, TOM JOHNSON (Assoc. M. '33; M. '47) Project. Engr., City of San Diego, Civic Center (Res., 969 Scott St.), San Diego 6, Calif.

ANDERSON, JON DAVID (Jun. '37; Assoc. M. '47) Chf., Eng., Supply and Services Branch, K-25 Clinton Production Div., U.S. Atomic Energy Comm., P.O. Box E (Res., 100 Norwood Lane), Oak Ridge, Tenn.

APPEL, THEODORE BURTON, JR. (Jun. '29; Assoc. M. '37; M. '47) Chf. Engr., The C. S. Johnson Co. (Res., 905 West Hill St.), Champaign, Ill.

BENTON, FRANK WILLIAM (Jun. '30; Assoc. M. '41; M. '47) Engr., Corp of Engrs., Clock Tower Bldg., Rock Island, Ill.

BITTILIO, ALADINO ALFONSO, JR. (Jun. '40; Assoc. M. '47) Field Engr., Sun Oil Co., 3530 Bigelow Blvd., Pittsburgh (Res., 84 Valley View Drive, R.D. 2, Library), Pa.

BLINE, EDWIN JASPER (Jun. '28; Assoc. M. '33; M. '47) Engr. (Civ.), U.S. Bureau of Reclamation (Res., 317 Alderson), Billings, Mont.

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DERBY, RAY LYLE (Assoc. M. '27; M. '47) Prin. San. Engr., Dept. of Water and Power, 207 South Broadway (Res., 4766 Edgewood Place), Los Angeles 6, Calif.

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HANSON, TERENCE CHARLES ST. ALWYN (Assoc. M. '30; M. '47) Asst. Chf. Res. Engr., Great Western of Brazil Ry. Co. Ltd., Caixa 114, Pernambuco, Brazil.

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HARVEY, FRANCIS STEPHEN (Jun. '37; Assoc. M. '47) Cons. Engr., 141 Dewey St., Worcester 3, Mass.

HIGHTOWER, CHARLES LEE, JR. (Jun. '38; Assoc. M. '47) Bridge Designer, State Highway Dept., Bridge Div. (Res., 3314 Coles Rd.), Columbia 6, S.C.

HOLMES, JOSEPH MARK (Jun. '34; Assoc. M. '37; M. '47) Cons. Engr., Kanab, Utah.

HOWE, WARNER (Jun. '41; Assoc. M. '47) Structural Engr. (Gardner & Howe), 76 Porter Bldg., Memphis, Tenn.

JOHNSON, CARL BURDETT (Jun. '39; Assoc. M. '47) Structural Engr. (Johnson & Minasian, Cons. Structural Engrs.), Room 409, 233 South Broadway, Los Angeles 12, Calif.

KADIE, CARL HENRY, JR. (Jun. '35; Assoc. M. '47) Dist. Mgr., Delta Dist., U.S. Bureau of Reclamation, P.O. Box 1407, Sacramento, Calif.

KEESE, OLIVER DE LA VERGNE (Assoc. M. '26; M. '47) Div. Engr., County Engr. and Surveyor, 313 Civic Center Bldg., 205 South Broadway, Los Angeles 12, Calif.

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KIELY, JOHN ROCHE (Jun. '31; Assoc. M. '38; M. '47) Gen. Mgr. Projects Div., Bechtel Corp., 4620 Seville, Vernon (Res., 4209 Hawthorne, Palos Verdes Estates), Calif.

KLEMA, ROY LESTER (Jun. '43; Assoc. M. '47) Civ. Engr., (Walsh and Klema, Civ. Engrs.), 1781 West 8th St., Los Angeles 14, Calif.

LEESON, ELWOOD RICHARD (Jun. '40; Assoc. M. '47) Asst. Dist. Engr., U.S. Geological Survey, Water Resources Branch, Surface Water Div., 510 Rudge-Guenzel Bldg., Lincoln, Nebr.

MANDRY, JAMES ELMER (Jun. '35; Assoc. M. '47) Civ. Engr. P-4, U.S. Bureau of Reclamation, Denver Federal Center (Res., 902 Poplar St.), Denver, Colo.

MARINER, HOBART GRAHAM (Jun. '37; Assoc. M. '47) Hydr. Engr., Standard Pipe Line Co., P.O. Box 591, Tulsa, Okla.

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MCKEAN, JAMES PERCIVAL (Jun. '26; Assoc. M. '30; M. '47) Prof., Dept. of Gen. Engr., Iowa State College (Res., 703 Stanton Ave.), Ames, Iowa.

MCWHORTER, WAYNE WHITTEN (Jun. '38; Assoc. M. '47) Erecting Engr., Koppers Co., Inc., Engr. and Constr. Div., Kearny, N.J.

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PATTERSON, CHARLES BIRD (Jun. '36; Assoc. M. '47) Engr., Chf., Corps of Engrs., Research Center, Waterways Experiment Station, Vicksburg, Miss.

ROGERS, GLENN HERBERT (Jun. '44; Assoc. M. '47) Architectural Engr., U.S. Navy, Public Works Office, 12th Naval Dist., San Francisco (Res., 23 Buena Vista Place, Oakland), Calif.

RUGE, ARTHUR CLAUDE (Assoc. M. '35; M. '47) (Ruge de Forest, Cons. Engrs.), 76 Massachusetts Ave., Cambridge 39, Mass.

SAHINEN, GEORGE FREDOLF (Assoc. M. '43; M. '47) Chf. Designing Engr., State Water Conservation Board, Armory Bldg. (Res., 523 Sixth Ave.), Helena, Mont.

SANTRY, ISRAEL WOOTAN, JR. (Jun. '40; Assoc. M. '47) Associate Prof. of Civ. Eng., Southern Methodist Univ., Dallas 5, Tex.

SCHOEN, BERTALAN (Jun. '25; Assoc. M. '27; M. '47) Engr., Borsari Tank Corp., 25 Broad St., New York, N.Y. (Res., 111 Nesbit Terrace, Irvington 3, N.J.)

SCHULEEN, ERNEST THEODORE (Jun. '27; Assoc. M. '35; M. '47) Hydrographic Engr., Pennsylvania Water & Power Co., Conestoga, Pa.

SHEINWALD, BENJAMIN SCHELLENBERG (Jun. '36; Assoc. M. '47) Archt., 85 South St., Boston (Res., 74 Browne St., Brookline 46), Mass.

SHELTON, MERCEL JOSEPH (Assoc. M. '42; M. '47) Asst. Mgr. and Engr., La Mesa, Lemon Grove & Spring Valley Irrig. Dist., 4760 Spring St. (Res., 8710 Hayes St.), La Mesa, Calif.

SHIPMAN, ROY MARVIN (Jun. '42; Assoc. M. '47) Cons. Engr. (R. Marvin Shipman), 301 Parland Place, San Antonio, Tex.

SKELTON, RUSSELL ROY (Assoc. M. '32; M. '47) Prof. of Civ. Eng., Univ. of New Hampshire, Conant Hall (Res., 43 Madbury Rd.), Durham, N.H.

SMITH, EDWARD EPHRAIM (Assoc. M. '38; M. '47) Gen. Supt., Dept. of Water and Sewage Treatment, City of Lima, 119 West High St., Lima, Ohio.

SMITH, WILLIAM HOWARD (Assoc. M. '26; M. '47) Dist. Engr., U.S. Public Roads Administration (Res., P.O. Box 487), Carson City, Nev.

TATUM, ROBERT LEE (Jun. '09; Assoc. M. '14; M. '47) Cons. Engr., 413 Levy Bldg., Shreveport, La.

THOMAS, EDWARD HARPER (Assoc. M. '43; M. '47) Bridge Plans Engr., State Highway Comm. (Res., 933 Eighth Ave.), Helena, Mont.

TIMBY, ELMER KNOWLES (Jun. '29; Assoc. M. '34; M. '47) Prof. and Head, Dept. of Civ. Eng., Princeton Univ., Eng. Bldg., Princeton, N.J.

VAN HORN, EMERY LAMARTINE (Assoc. M. '40; M. '47) Area Mgr., U.S. Atomic Energy Comm., Upton (Res., Bell St., P.O. Box 769, Bellport), N.Y.

WANKE, IRVIN ROBERT (Jun. '36; Assoc. M. '47) Constr. Engr., Riverside Cement Co., Oro Grande (Res., Victorville), Calif.

WESKE, RICHARD FERDINAND (Assoc. M. '39; M. '47) 1198 Keeler Ave., Berkeley 8, Calif.

WOLF, HERBERT CHARLES (Jun. '38; Assoc. M. '47) Administrative Engr., Russell & Axon, Cons. Engrs., 408 Olive St., St. Louis (Res., 6216 Dexter, Affton 23), Mo.

YOUNGQUIST, CARL VERNON (Assoc. M. '31; M. '47) Chf. Engr., Ohio Water Resources Board, 706 Ohio Departments Bldg., Columbus 15, Ohio.

ZABRISKIE, JOHN HOWARD (Jun. '35; Assoc. M. '47) Asst. Engr., Dept. of Army, R. and H. Div., 120 Wall St., New York (Res., 35-63 Eighty-ninth St., Jackson Heights), N.Y.

ZAPP, LLOYD OTTO (Jun. '34; Assoc. M. '47) Asst. Div. Civ. Engr., Humble Oil and Refining Co., P.O. Box 1271, Corpus Christi, Tex.

Reinstatements

BLOMGREN, WALTER EDWARD, M., Asst. Director, Region 7, Bureau of Reclamation, 314 U.S. Custom House, Denver 2, Colo., readmitted Oct. 20, 1947.

DUNCAN, RICHARD MELBURN, Affiliate, Care, B-D-R Eng. Corp., 14th and Howell, North Kansas City, Mo., reinstated Jan. 1, 1948.

HUSBAND, ALEXANDER CHAPMAN, Assoc. M., Comdr., CEC, U.S.N., Bureau of Yards and Docks, Office of Superintending Civ. Engr., Room 306, 1212 Lake Shore Drive, Chicago 10, Ill., reinstated Nov. 24, 1947.

KEITH, WARREN GRAY, Assoc. M., Asst. Prof., Dept. of Civ. Eng., Univ. of Alabama, Box 2045, University, Ala., readmitted May 19, 1947.

MIMS, STALEY WOOD, Assoc. M. (Mims Eng. Co.) (Res., 103 Lazy Lane), Crockett, Tex., reinstated Nov. 18, 1947.

NELSON, HERBERT WILLARD, JR., Jun., Apt. I, 5218 One Hundred and Tenth N.E., Kirkland, Wash., reinstated Dec. 2, 1947.

NYE, HENRY LYNN, M., Head of Design Unit, South Platte River Dist., Region 7, U.S. Bureau of Reclamation, Bldg. 11, Denver Federal Center (Res., 1225 Colorado Blvd.), Denver, Colo., readmitted Oct. 20, 1947.

PAUL, VIVIAN GAINES, JR., Jun., Rodman and Chairman, Chester F. Wright, Engr., P.O. Box 967 (Res., 1224 South "N" St.), Lake Worth, Fla., reinstated Dec. 2, 1947.

REDD, CARL LEITNER, M., Associate Engr., Van Rensselaer P. Saxe, Cons. Engr., 100 West Monument St., Baltimore (Res., Shawan Rd., Cockeysville), Md., readmitted Oct. 20, 1947.

SCOTT, JAMES MORRISON, Jun., 104 Bartley Road, Pittsburgh 16, Pa., reinstated Nov. 4, 1947.

SMITH, MORTIMER WILSON, JR., M., Engr., Public Service Commission of West Virginia, Capitol Bldg., Charleston (Res., 100 Alexander Ave., Clarksburg), W.Va., readmitted Oct. 20, 1947.

STEVENSON, HOMER EADS MACGREGOR, Assoc. M., Dist. Engr., Socony-Vacuum Oil Co. of Venezuela, Apartado 246, Caracas, Venezuela, reinstated Dec. 2, 1947.

SYLVESTER, WILLIAM LAPP, Assoc. M., Senior Civ. Engr., City of New York Dept. of Public Works, Municipal Bldg. (Res., Hotel Latham, 4 East 28th St.), New York 16, N.Y., reinstated Nov 12, 1947.

THOROUGHMAN, FRANK MARION MATHEWSON, Assoc. M., Engr., Corps of Engrs., Upper Mississippi Val. Div., 746 U.S. Court House and Custom House (Res., 4401 Athlone Ave.), St. Louis 15, Mo., readmitted Oct. 20, 1947.

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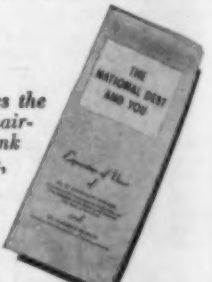
a 12-page pocket-size brochure, expresses the views of W. Randolph Burgess, Vice Chairman of the Board of the National City Bank of New York—and of Clarence Francis, Chairman of the Board, General Foods Corporation. Be sure to get your copy from the Treasury Department's State Director, Savings Bonds Division.



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EQUIPMENT, MATERIALS *and Methods*

NEW DEVELOPMENTS OF INTEREST, AS REPORTED BY MANUFACTURERS

Vibratory Subgrader

THE PRINCIPLE of vibration has been applied to the work of excavating subgrades for paving construction. Experimental models have been under test and trial since before the war. The application of vibration is a method of replacing brute effort with a repetitive force and achieves greater efficiency in cutting through the earth or shaving the subgrade material to a given grade and crown.

By the use of vibration, the new subgrader is reported to reduce power consumption and lower the cost per square yard of preparing the subgrade. There is also a reduction in the number of moving parts, with consequent maintenance economy. Extensive trials have revealed that the vibrating cutting edge will penetrate through the hardest material without transmitting shock or movement into the road forms. The new unit will produce accurate grade, true to crown and cross section. To give final shape to the subgrade, the machine has a two-wheel strike off which is adjustable for crown and width and is equipped with a control lever for raising or lowering the blades.

All necessary corrections to the subgrade are made before the strike-off passes over the grade. Fines for filling any small hole or irregularity, and to complete the final screeding-in operation, are provided by small vertical openings in the cutter assembly. The vibration of the soil-covered cutter assembly sifts only fine material through these openings and feeds the material to the strike-off on the same principle as a vibrating screen. **Blaw-Knox Company-Blawknox, Pa.**

Tractor Cab

A NEW, ALL-STEEL welded cab, designed exclusively for attachment on the new 115-hp "Caterpillar" diesel DW 10 wheel-type tractor is now announced in production. Offering year-around utility of the tractor and eliminating the threat of job interruptions due to inclement weather, the cab provides increased comfort for operators and complete protection from the elements. Of durable construction similar to that of the cab offered with the "Caterpillar" Diesel Motor Grader, the new cab permits maximum visibility and maneuverability for the operator. **Caterpillar Tractor Co., Peoria, Ill.**

Portable Trough Conveyor

THE PORTABLE TROUGH CONVEYOR has been designed especially for the handling of all loose materials such as sand, gravel, stone, loam, etc., from hopper bottom cars to trucks or storage piles or from storage piles to trucks, etc., and is ideally suited for handling concrete from mixers to forms. It is built in standard belt widths

of 16, 20, and 24 in., and standard lengths from 20 to 60 ft in multiples of 5 ft, has a capacity from 60 to 180 tons, and is fitted with electric motor or gasoline engine mounted on steel or rubber-tired wheels. **George Haiss Mfg. Co., Inc., Div. of Pettibone-Mulliken Corp., New York 51, N. Y.**

Diesel Engines

RECENTLY DEVELOPED are engines of particular interest to users of mobile equipment. These engines are of the high-speed, light weight, heavy duty type. Model DIX-6 is a small six-cylinder diesel with a $3^{3}/_{8}$-in. bore and 4-in. stroke. This engine is capable of operating successfully at speed up to 3,000 rpm. The stripped engine develops 93 hp and only weighs approximately 750 lb. The DNX-V8, built in three sizes, is a 45° V engine. The supercharger on this engine is gear driven and is an integral part of the engine itself. The stripped engine weighs approximately 4,600 lb.

Model DIX-4 is a 4-cylinder diesel engine that parallels the model DIX-6 in design, performance features, and in its interchangeability with gasoline engines of similar power capacity. The stripped engines weigh approximately 600 lb. Model DJXHF, horizontal engine, develops 99-hp maximum power at 2,600 rpm. The stripped engine weighs approximately 900 lb. Model DWXLDF, horizontal engine with $4^{1}/_{2}$-in. bore and 5-in. stroke, develops 142 hp at 2,600 rpm. The stripped engine weighs approximately 1,300 lb. Model DFXHF develops 260 hp at 2,100 prm. The stripped engine weighs approximately 2,600 lb. **Hercules Motors Corps., Canton, Ohio.**

Unbalanced Load Vibrator

A NEW UNBALANCED LOAD VIBRATOR is now in use as an accessory to Hapman rubber flighted sealed pin chain pipe conveyors. Vibration is delivered directly to rubber flight through a hole in the pipe and base. Under dust-tight conditions impact bar is sealed. Impact bar is mounted on oscillating plate held by a rubber sandwich which controls amplitude of oscillations by means of its adjustable compression. Speed of rotation and amount of eccentricity determines force of repetitive impact. Since the impact bar strikes only the rubber portion of the flight, it is practically noiseless. Localizing the action of vibration to that portion of chain over the discharge opening minimizes power required and assures effectiveness. **Hapman Conveyors, Inc.., Detroit, Mich.**

Carryall Truck

A 50-TON CARRYALL with 16 tires was used by Kissick Transporation Co., Belle Fourche, S.Dak., to move this huge tank from Belle Fourche to a point in Wyoming 20 miles away. Measuring 34 ft high with

a diameter of 28 ft and weighing 25 tons, the tank was too big for rail movement, and the hauler had to build a temporary road two miles across the Belle Fourche River. The tractor was a White powered by a Cummings diesel. **Fruehauf Trailer Co., Detroit, Mich.**

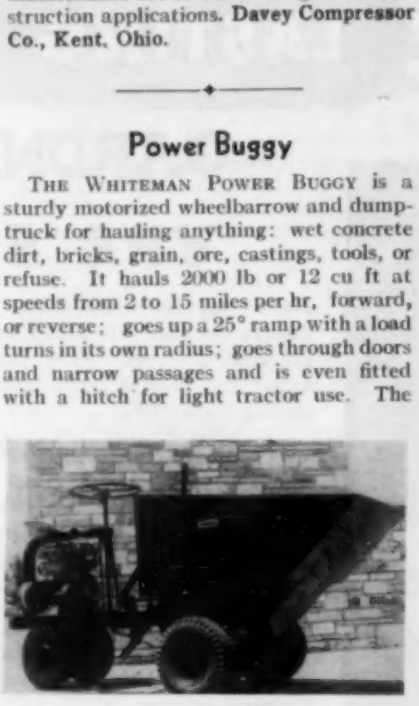
Auto-Air Compressor-Winch

RECENTLY DEVELOPED is a new truck mounted "Auto-Air" compressor-winch assembly. Power for operation of both compressor and winch is transmitted from the truck engine by a Davey Heavy Duty Power Take-off installed in the truck driveshaft. Countershaft with two individual Twin Disc clutches provides for either simultaneous or separate operation of compressor and winch. The compressor is a standard Davey Model 105-10 "Auto-Air." It delivers 105 cfm at 100 lb pressure. Winch is of 25,000 lb capacity. Air receiver and double hose reel

are mounted beneath the truck platform, thus effecting substantial space savings. The unit extends only 40 in. behind the truck cab, leaving ample space for the transporation of men, tools, and materials and is 38 in. high. The assembly is recommended especially for pipe line, public utility, railway, mining and airport maintenance use as well as for general construction applications. **Davey Compressor Co., Kent, Ohio.**

Power Buggy

THE WHITEMAN POWER BUGGY is a sturdy motorized wheelbarrow and dump-truck for hauling anything: wet concrete dirt, bricks, grain, ore, castings, tools, or refuse. It hauls 2000 lb or 12 cu ft at speeds from 2 to 15 miles per hr, forward, or reverse; goes up a 25° ramp with a load turns in its own radius; goes through doors and narrow passages and is even fitted with a hitch for light tractor use. The



Power Buggy, with single wheels is only 28 in. wide, with dual wheels is 36 in. wide. Tires are standard wheelbarrow tires. Rear wheel drive and full 360° rotating drive mounting make it easy to turn in its own radius or to reverse. Power is provided by a 6-hp, 4-cycle, air-cooled gasoline engine with an automatic clutch and variable speed changer through worm gear reducer. Its light weight (750 lb), high maneuverability and narrow width adapt it for scaffold and upper story work. The bucket height of 34 in. enables it to load at most concrete mixers without pit or platform. **Whiteman Manufacturing Company, Los Angeles 26, Calif.**

Offset Strainer

AN OFFSET SINLEX STRAINER has been developed to permit the strainer to be completely drained as the line itself is drained. With the inlet and outlet at right angles the unit can be installed to form a right angle connection in a piping system. The basket and basket chamber can be made to any length, depending upon the amount of entrainment in the stream. Cover is removable for lifting out the perforated strainer basket. A cleanout plug is furnished to permit steam blowdown cleaning when practical. The strainer is made in cast bronze, steel, semisteel, or iron, or alloyed metals for corrosion resistance. Types are available for working pressures from 125 to 300 lb in sizes from $1^1/_2$- to 12-in. flanged, screwed, or welding connections. **J. A. Zurn Mfg. Co., Erie, Pa.**

40-Ft Crane Truck

A NEW CRANE TRUCK with a full 40-ft reach has been announced. Designed especially for use in the construction and maintenance of high buildings, it is also valuable in lifting material into and out of excavations; loading and unloading ships and rail cars; maintenance and construction of railways; and odd hoisting and transporation jobs in yards, depots, and out-of-doors storage areas.

The 40-ft boom is constructed in 10-ft sections. The center sections can be removed to provide 20- and 30-ft booms when longer lengths are not needed. The capacities of the boom at full length are: 1,500 lb at a 7-ft outreach, 3,620 lb at 9 ft and 2000 lb at 19 ft. At its shortest length, the boom has a capacity of 10,000 lb. The crane truck weighs 19,880 lb; has a balancing point at the 19-ft outreach of 1,125 lb; has electric elevating and boom-ing limit controls; is equipped with 22 in. diameter by 10-in. wide traction and trailer tires; has a 270-deg steering range; is equipped with outriggers on both sides for hoisting capacities up to 10,000 lb; and has a lazy arm boom-stop to prevent loads from swinging past the pivot point of the boom. **Yale & Towne Mfg. Co., Philadelphia Div.**

Rotary Snow Plow

A ROTARY SNOW PLOW, called the Sno-Master, is a self-contained unit which can be attached to or detached from almost any 2½ to 5-ton four-wheel drive truck. There is no extra power unit to mount and no special transmission is required.

The SnoMaster can be used to open drifts of any depth, in snow of any consistency—wet or dry, soft or frozen. Rotary picks driven by chains and suspended by springs in front of the plow can be raised or lowered by hydraulic controls in the truck cab to break down drifts or cut away frozen snow on the ground. The 38-in. auger is ball-bearing mounted and is driven through a shear pin flange for safety. Rotor is a disk with six blades of special steel and provided with a shear pin. An 8-cylinder, 114-hp engine equipped with starter and generator supplies the power. Drive is through fluid drive and flexible coupling. Transmission is in a compact, dustight case. A specially designed chute, controlled from the operator's cab, will throw the snow to the right or left. A removable loader hood at the top of chute, also controlled from the cab, can be adjusted so the snow can be blown way off the road or airport runway or directly into trucks when cleaning city streets.

The SnoMaster weighs approximately the same as a heavy-duty push plow so it can be quickly interchanged with one-way or V-plow by using the same attachments. This makes it possible to get double duty from your trucks without a major operation. **Iowa Manufacturing Co., Cedar Rapids, Iowa.**

Literature Available

PRECISION PRODUCT BULLETIN—Bulletin #10,000 gives descriptions and illustrations of all Falk precision products such gears and speed reducers, motoreducers, couplings, high-speed drives, backstops, marine drives and special gear drives. Available services and facilities including steel casting, maching weldments, and engineering are also described. **The Falk Corp., Milwaukee, Wis.**

PHOTOGRAPHIC PAPER FOR REPRODUCING—Kodagraph Autopositive Paper, a revolutionary silver-sensitized paper for reproducing engineering drawings is described in a new, eight-page pamphlet. Designed for use in normal room illumination with standard blueprint or direct process printers, Kodagraph Autopositive Paper produces a high contrast positive copy directly from a positive original. The booklet describes the use of the paper for such problems as reproducing opaque drawings, worn, stained, or discolored tracings, or direct process prints or blueprints. **Industrial Photographic Div., Eastman Kodak Co., 343 State St., Rochester 4, N. Y.**

VAPOR SAVING SYSTEM—The method of determining which of the flat-bottom tanks in a vapor-saving system to equip with a lifter-roof and the method of computing the correct sizes of vapor lines connecting the tanks is described in a new 13-page booklet. The vapor pressure of the stored product, the expansion of the air-vapor mixture, and the flow of vapor in the vapor lines can be read directly from the charts and tables included in this booklet. The details of the Horton Liquid-Seal Lifter Roof tank are shown in several elevation, plan, and sectional drawings. A typical vapor-saving system, including three cone roof tanks and one Horton Lifter-Roof tank, is shown in a diagrammatic sketch supplemented with the necessary calculations for designing the system. **Chicago Bridge & Iron Co., Chicago, Ill.**

ARC WELDERS—A 36-page, 3-color catalog, now available, contains illustrations, descriptions, dimensions, and specifications on its complete line of "Simplified" arc welders which includes electric motor-driven d.-c. welders in 5 sizes from 150 to 600 amp; gasoline engine-driven welders in 4 sizes from 200 to 600 amp; a.-c. transformer-type welders in 3 sizes from 200 to 500 amp; welding generators only in 3 sizes from 150 to 400 amp; gasoline engine-driven welders with auxiliary a.-c. or d.-c. power generators; and other models in all sizes for special arc-welding applications. Various features comprising the machines are individually illustrated and described, and helpful information is given for various welding problems. Also listed is the complete line of Hobart arc welding electrodes and accessories. **Hobart Bros. Co., Troy, Ohio.**

Literature Available (Cont.)

WATERPROOFING—In correction of a news release of literature available appearing in the November issue of CIVIL ENGINEERING, a 12-page booklet describes a process of waterproofing leaky basements, etc., from inside against hydrostatic pressure. Instead of being offered by Stix, Baer & Fuller Drygoods of St. Louis, that company had its basement waterproofed by this process 32 years ago and it is resisting a 7-ft head pressure 35 ft below the basement floor. The booklet is offered by **Ranetite Mfg. Co., Inc., 1917 South Broadway, St. Louis, Mo.**

PRESSURE AND LEVEL CONTROL CATALOG—The Kontrol Motor line of pressure regulators and diaphragm motor valves is described in a new 100-page catalog. The equipment illustrated capitalizes fully on production methods evolved since the war, and several units shown are said to represent the greatest advances in equipment of this type in the last 50 years. The new catalog is made up of five sections covering in addition to diaphragm valves, liquid level controllers, strainers, pressure reducing and regulating valves, pump governors, and such steam plant equipment as back pressure valves, atmospheric relief valves, diaphragm relief valves, oil and grease extractors, and exhaust heads. No broadcast distribution is planned for the catalog No. 47, but copies are available for steam plant and process industry engineers designers, and purchasing personnel, on request. **Kieley & Mueller, Inc., North Bergen, N. J.**

SELF-PRIMING PUMP—An automatic, self-priming pump equipped with a new type automatic spring valve which is said to give faster, smoother transition from priming or vacuum pumping to straight centrifugal action, is described in an eight-page illustrated bulletin. According to the bulletin, the pump's portability, rapid installation, quick priming features and the non-clog design of its open impeller types, make it a valuable tool in almost every industry. It is adaptable to any drive and is available in five sizes to cover ranges and conditions diagramed in bulletin No. 08B6319B, **Allis-Chalmers Mfg. Co., Milwaukee, Wis.**

TERRA-COBRA—EARTHMOVER—Improved operation and construction features of the Wooldridge Terra-Cobra high-speed self-propelled earthmovers are fully illustrated and described in a 12-page bulletin. Descriptive data is combined with on-the-job photographs to show engineers, contractors, and equipment owners how Wooldridge Terra-Cobras are used to gain greater yardage profits in earthmoving operations. The positive two-wheel hydraulic steering action, pioneered by Wooldridge five years ago, plus the flexibility articulated oscillating kingpin pivot are among the features covered in detail by the bulletin. **Wooldridge Mfg. Co., Sunnyvale, Calif.**

Literature Available (Cont.)

WELDING BULLETINS—Two recent bulletins are now announced as special reprints. Entitled "Arc Welding Problems Successfully Solved," one bulletin covers welding cast-iron, low- and high-alloy steels, stainless steel and tool steels to high-carbon steels; welding special manganese parts, elimination of undesirable characteristics, and other problems occurring in everyday welding. Twelve production case histories are presented. The other bulletin, "Another Major Advance in Gas Welding" describes the use and applications of various new developments in the field of special flux-coated alloys known as EutecRods, for steel, cast-iron, brass, and aluminum. Correct welding procedures, together with physical properties, charts, and valuable technical data are outlined and illustrated. Applications discussed include steel, cast-iron malleable, bronze, brass, and copper. **Eutectic Welding Alloys Corp., 40 Worth St., New York 13, N.Y.**

SHOVEL, CRANE, AND DRAGLINE—A 24-page bulletin now offered contains a complete detailed description of the Lima Type 604 shovel, crane, and dragline. Many illustrations are contained in the new bulletin showing details of construction and operating advantages including the application of "precision" air control. Liberal space is given to specifications, capacities, and working ranges. As a shovel the Type 604 has a capacity of $1^1/_2$ cu yd; as a dragline, variable. **Lima Shovel and Crane Div., Lima-Hamilton Corp., Lima, Ohio.**

PORTABLE SAW—The new, lightweight, model No. 1 Timberhog gasoline-driven chain saw is described in a four-page, illustrated folder. The primary advantages attributed to the Timerhog are: it does all the operations, is five times faster than hand sawing, the horsepower delivers far in excess of load requirements, it is lightweight, low in price, and low in maintenance and operating costs. **Reed-Prentice Corp., C-1, Worcester, Mass.**

SAND, GRAVEL, ORE EQUIPMENT—A 24-page illustrated bulletin is offered on washers and classifiers for metallic and non-metallic ores. Features, general design, and operations are described, pictured, and diagramed. Specific instructions on installation and special equipment are also included in the bulletin. **Eagle Iron Works, Des Moines, Iowa.**

SURFACE PLYWOOD FORMS—A Pamphlet "How to Pour Concrete" describes five reasons for the use of KIMPREG surfaced plywood forms in pouring concrete: namely, increases life of concrete form, produces surface smoothness equal to steel forms, cuts maintenance costs, easily constructed, reduces rubbing. **Kimberly Clark Corporation, Neenah, Wisconsin.**

Sea-Level Panama Canal Dictated by New Weapon Dangers

Nine Papers on Panama Canal Presented at Society's Annual Meeting

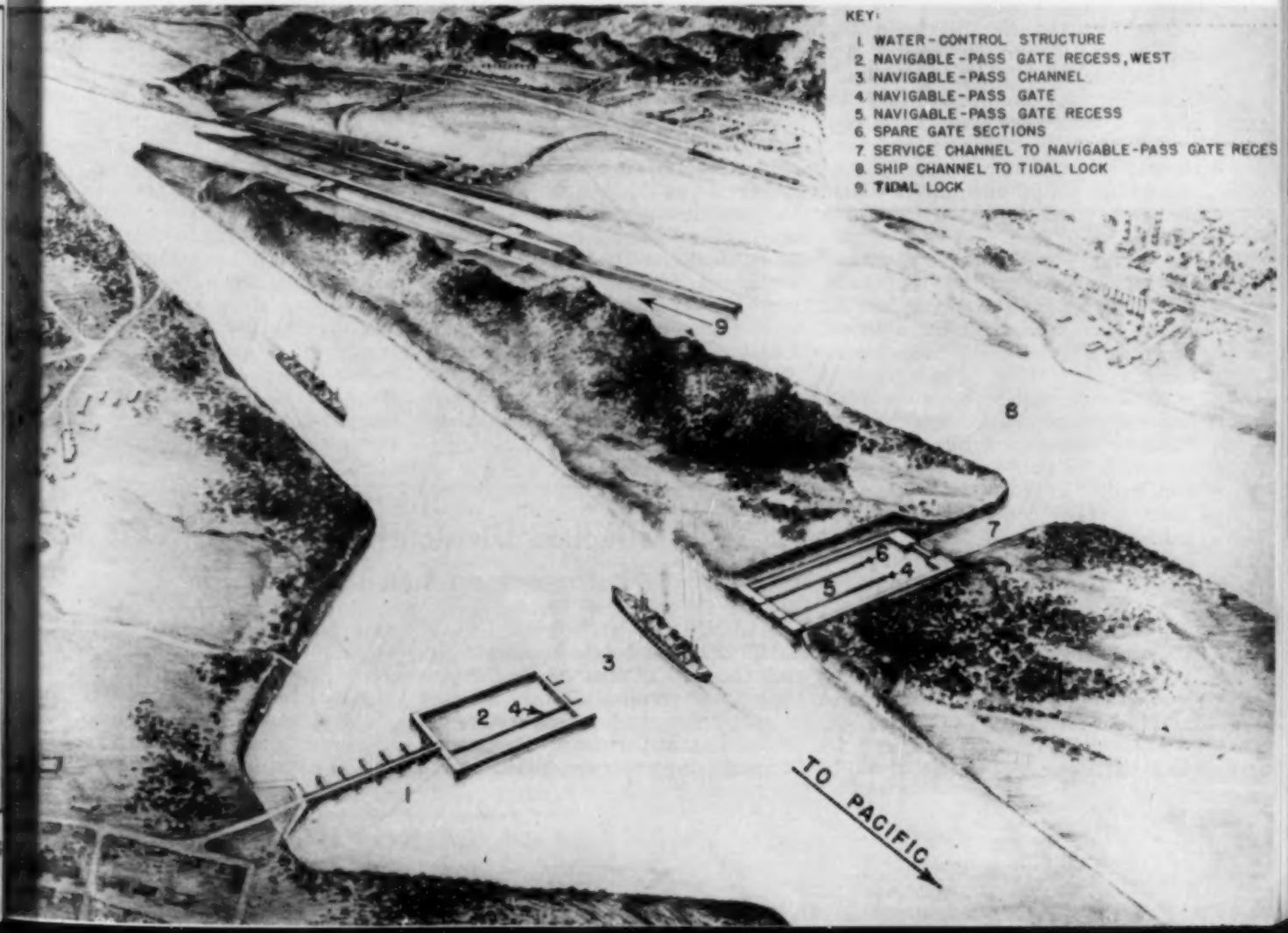
ATOMIC BOMBING, rockets and guided missiles, for which no "effective resistance" has been developed, present such dangers as to dictate conversion of the lock-and-dam Panama Canal into a sea-level waterway whose chief value would lie in the near-indestructibility of the virtually structureless project.

These facts were revealed in a paper presented at the Society's 95th Annual Meeting by Col. James H. Stratton, M. ASCE, of the Corps of Engineers. As supervising engineer of the Panama Canal Special Engineering Division, he headed the engineering committee authorized by Congress to make a special two-year study of "means for increasing the capacity and security" of the Canal. He spoke at a Wednesday afternoon session devoted to his keynoting of the symposium forming the theme of the four-day meeting, and at ensuing sessions of the Society's Technical Divisions at which first-hand accounts of the study's technical aspects were given by the engineers who made it. The symposium was of special interest to the ASCE, whose members have been closely associated with the development of the Panama Canal since its inception.

"No other site offers advantages comparable with those of the Canal Zone for either a lock or sea-level Isthmian canal," Colonel Stratton said, touching on another phase of the proposal recently placed before Congress by Governor J. C. Mehaffey of the Canal Zone that a ten-year project, estimated to cost $2,483,000,000, be initiated to replace the present destructible lock-and-dam canal with a sea-level route. The Governor's proposal was based on the findings of the Special Engineering Division and a board of consultants made up of members of the American Society of Civil Engineers, and came in a report he filed at about the same time that differences cropped up between the United States and the Panamanian government over leases for Canal defense bases.

"Investigations disclose that only an Isthmian sea-level canal will meet

OW AND WHY PANAMA CANAL should be converted into sea-level waterway, with present locks and dams eliminated, as means of eeting threat of atomic bomb attack, is central theme of papers presented at 95th Annual Meeting of ASCE in Hotel Commodore, January -24. Symposium heard by almost 2,500 attending one of largest meetings in Society's annals is based on two-year study leading to recomenda tion made recently to Congress by Governor J. C. Mehaffey of Canal Zone, namely, that a ten-year project estimated to cost $2,483,-00,000 be initiated to meet future security and capacity demands. Sketch (below) shows proposed tidal locks for largest single construction roject in history. Over billion yards of excavation is included in this mammoth undertaking.



the future needs of interoceanic commerce and national defense," Colonel Stratton asserted. "The present lock canal could be improved at a cost of $129,983,000 to meet the needs of commerce for the remainder of this century. A lock canal designed to meet the future needs of commerce and having the maximum security feasible in this type of canal would require new locks and strengthened summit lake impounding dams, and although costing $2,307,686,000, would still be deficient in resistance to modern weapons.

"A sea-level canal at Panama constructed by the conversion of the existing lock canal could not be destroyed by the enemy. Only the atomic bomb could cause significant interruption in service, and then for not more than a few weeks. Navigation would be practicable in the sea-level canal even though tidal currents were not regulated. Tidal regulation would be provided for greater safety to shipping, by means of a tidal lock and a navigable pass, the latter allowing the utilization of the canal as an open waterway as a matter of routine daily operation. In the event of damage to the tidal-regulating structures, the gates of the pass could be quickly removed and the canal operated as an open waterway."

Declaring that "there have been no developments since the advent of the V-2 weapon that offer effective resistance to the penetration of defenses by rockets and guided missiles," Colonel Stratton emphasized that "to live as a nation we must shield our own weapons so that we can take counter-measures to prevent exploitation of any initial advantages which the enemy may gain by surprise attack."

Asserting that "it is clear now that the lock structures could not have withstood Japanese bombing had an attack been made and the defenses penetrated," Colonel Stratton continued:

"Prudence requires that we plan our communications, such as the Panama Canal, and our vital war industries so that we would not be hopelessly crippled if attacked. There is no doubt that rockets, guided missiles, or robot planes loaded with powerful conventional or atomic explosives launched from the air, from ship or submarine at sea, or from a land base, could penetrate the Canal defenses and destroy the vulnerable locks. A single sneak attack would suffice to destroy the lock gates and drain Gatun Lake to the sea."

Colonel Stratton warned that by 1960 the capacity of the Canal will be inadequate to accommodate traffic without undesirable delays on peak days unless additional capacity is provided.

"A limitation of the present Canal that became increasingly intolerable with the approach of the recent war is that imposed by the locks which, because of their size (width 110 ft, and length of chamber 1,000 ft) had restricted the design of Navy ships.

"Security considerations restrict public evaluation of the protective designs in relation to the various weapons that could be employed in an attack. It can be said, however, that the lock canal cannot be made resistant either to atomic bombs or to modern conventional weapons. The best protection that could be provided would materially increase the difficulties of successfully attacking the Canal and rendering it useless for extended periods of time.

"However, breaching of the modernized locks could be effected by a determined enemy and the canal knocked out of use for periods up to four years. The extent of damage and the length of the period of traffic interruption would depend on the nature of the weapon employed and the intensity of attack. Radioactive contamination would make repairs to the locks difficult, if not impossible. The lock type of canal, no matter how strongly constructed, would not increase security to meet the needs of national defense."

In listening to the details concerning the $2,483,000,000 proposed project, which would be the largest single construction undertaking in history, engineers attending the meeting recalled that at the Annual Meeting of the ASCE two years ago a similar sea-level canal had been proposed, and that its cost had then been estimated at $1,310,400,000, or little more than half the present estimated cost. The speaker then was John G. Claybourn, superintendent of the Panama Canal dredging division, who urged a sea-level canal as a means of streamlining it "for maximum safety and unlimited capacity."

In proposing the sea-level route in January 1946, Mr. Claybourn declared that atomic bombing of the Panama Canal would do no more damage than "could be taken care of promptly with a little dredging." He emphasized also that such streamlining would be no modernistic concept, but would be achieved "by turning back the clock 40 years to convert the present canal into the lockless, damless, sea-level cut across the Isthmus recommended by a majority of the engineers on the commission which studied the project in 1905–1906."

Like Mr. Claybourn, Colonel Stratton pointed out that the lock-and-dam canal constructed on recommendation of a minority of the engineers on the turn-of-the century commission was justified for reasons of economy and speed and that the Canal was adequate in the face of attack weapons in use at that time.

In addition to Colonel Stratton's talk, eight papers were presented in the Panama Canal symposium before various Technical Divisions of the Society. These were before the Soil Mechanics and Foundations Division, where excavation slopes and strength of soils were discussed in relation to possible attack by atomic bomb and other modern weapons; the Construction Division, where discussion centered on improved techniques that will be required for the proposed project; the Hydraulics Division, where flood control and tidal currents in the proposed sea-level canal held the stage; and the Waterways Division, where emphasis was on channel design, traffic and capacity, and where a report was presented on model studies covering ship performance in restricted channels.

Authors of all papers in the symposium are engineers who participated in the study authorized late in 1945 by the 79th Congress through enactment of Public Law 280. The papers were discussed by members of the American Society of Civil Engineers who comprised a Board of Consultants utilized in the study.

Construction Division Hears Details, Cost Estimates on Canal Conversion

VARIOUS CONSTRUCTION METHODS and cost estimates covering the method selected for the proposed conversion of the Panama Canal into a sea-level route were detailed in that portion of the Panama Canal Symposium conducted at the two Thursday sessions of the Construction Division. Kirby Smith, New York, chairman of the Division's Executive Committee, presided. Between the meetings, the Division sponsored a luncheon at which construction topics were dis-

cussed in a series of brief, extemporaneous talks.

L. T. Crook, F. L. Dye, J. J. Rose and W. B. Watson, engineers of the Panama Canal Special Engineering Division, collaborated on a paper which disclosed that total excavation for the Canal conversion project would require removal of 1,070,000,000 cu yd, 750,000,000 cu yd to be excavated in the dry, and 320,000,000 cu yd of wet material to be dredged.

Stressing the fact that the conversion in a single stage by deep dredging is preferable to stage dredging because "it would be cheaper, requiring a shorter construction period, and would interfere less with Canal traffic," the paper also highlighted the following:

Large shovels or draglines of 25-cu yd capacity would be used.

Wet excavation would be performed by conventional dredges supplemented by special hydraulic and bucket-ladder dredges capable of dredging to a depth of 145 ft below water surface, deeper than any ever known to have been operated.

The single-stage conversion would save five years of the construction period over stage-dredging methods studied.

Material removed in both the wet and dry excavating operations would be loaded directly into dump scows for disposal in Gatun Lake, and some of the material would be utilized in flood control construction necessitated by the conversion.

Net savings of the deep-dredging plan over stage dredging are estimated at $130,000,000.

Personnel required would be reduced by 9,000 workers through use of the prescribed methods, with resultant savings reflected in the lower cost of housing, utilities, services and mobilization.

Man-hours required for the ten-year project would total 307,910, beginning with 7,460 the first year, accelerating to 41,330 and 41,360 the next two years, and diminishing slightly in the subsequent years.

About two-thirds of the required manpower would be unskilled and largely indigenous to the Caribbean area. Contracts with skilled and technical personnel, to be obtained from the United States, would include payment of transportation from the place of recruitment and return, and transportation of government workers' families and household furnishings would be provided.

Cement, steel and lumber would be obtained from the United States.

Committee on Applied Mechanics Arranges Two Structural Division Sessions

TWO SESSIONS, for which the program was prepared under the direction of the Committee on Applied Mechanics, were held by the Structural Division, with E. L. Durkee, Bethlehem, Pa., chairman of the Division's Executive Committee, presiding.

At the first session Thursday morning, Alexander Hrennikoff, Assoc. M. ACSE, Associate Professor of Civil Engineering, University of British Columbia, Vancouver, B.C., presented a paper on "Framework Method and Its Technique for Solving Plane Stress Problems." A second paper was by Mario G. Salvadori, Assoc. M. ASCE, Assistant Professor of Civil Engineering, Columbia University, New York, on "Computation of Buckling Loads by Finite Differences."

Three papers also were presented at the second session Thursday afternoon. Henson K. Stephenson, M. ASCE, Associate Professor and Research Engineer, Civil Engineering Department, Agricultural and Mechanical College of Texas, had a paper, "Live Loads for Highway Bridges Based on the Chance Grouping of Heavy Trucks in Traffic." F. L. Shanley, consulting engineer, Los Angeles, Calif., had a paper, "Applied Column Theory." The third paper, "Design Criteria for Beams with Semi-Rigid Connections," was by Bruce G. Johnston, M. ASCE, Professor of Civil Engineering and Associate Director of the Fritz Engineering Laboratory, Lehigh University, Bethlehem, Pa., and Robert A. Hechtman, Assoc. M. ASCE, Research Engineer in Civil Engineering, University of Illinois.

Henson K. Stephenson

Professor Stephenson presented a paper in which he used the theory of probability as an approach to the solution of problems associated with the behavior of highway traffic. His paper dealt with the problem of vehicle grouping from a mathematical standpoint, "based on the same laws of chance or probability that have already been used successfully for solving many other types of engineering problems."

His paper covered "a variety of typical problems relating to vehicle grouping, which illustrate how the method may be used for estimating approximately how often various sequences or groups of vehicles might be expected to occur within given lengths of time or distances along the highway."

This method would be useful, he pointed out, not only in the construction of highway bridges, where economies can be effected in concrete and steel, but also in determining the need for warning or stop lights at highway and street intersections, or the timing of traffic lights at such intersections for the most efficient movement of traffic.

Professor Stephenson explained how he had divided traffic into three categories—light, heavy and medium—and sought to work out the most probable behavior pattern of traffic.

"Traffic is an every-changing flow of vehicles whose behavior is, at first glance, incapable of prediction by mathematical means," he said. "Yet, if at any given location, the most probable traffic pattern and the most probable average speed are established, the most probable behavior of traffic can be predicted by mathematical means. Although the type of analysis discussed herein has been applied to only a limited number of observed traffic data, the high degree of correlaton between the observed and calculated results obtained from these studies indicates that the behavior of highway traffic coincides rather closely with the assumptions upon which the mathematical procedures were developed."

He emphasized that the main objective of his paper is to develop a method rather than to decide on numerical conclusions, and said:

"A highway bridge, in order to perform its function safely, must not only be designed for the maximum stresses which may occur only once during its useful life, but also for varying numbers of repetitions of other stresses, less than the maximum, that might otherwise result in a fatigue failure if the design stresses are not properly reduced to provide for them, or if the various numbers of high stress repetitions are not estimated correctly and on the side of safety. It would be a relatively simple matter to determine the maximum stresses produced on a given

bridge by the heaviest types of individual trucks found on the highways. However, at the present time, no satisfactory method has been developed for estimating how often two or more of these heavy trucks, or combinations of these and lighter trucks, might be expected to occur on various parts or lengths of a bridge at the same time. And since both the maximum stresses, and varying numbers of repetitions of lower stresses that might result in fatigue failure, are practically all produced by heavy vehicle groups rather than by individual trucks, it is highly important that a satisfactory method be developed for estimating how often these events would be expected to occur as a result of any given or anticipated traffic conditions."

Lockless Canal Would Permit Transit of Vessels Now Barred by Size

IN ADDITION to helping to meet the threat of atomic bomb attack, conversion of the Panama Canal into a sea-level water route would assure adequate capacity for the rest of this century and permit "transit of any type of vessel of any size, including much larger naval vessels than now exist." This emphasis on capacity of the Canal, which was incapable of transiting some of the larger naval vessels built or remodeled during World War II, marked the three symposium papers presented before the Waterways Division. W. W. De Berard, Chicago, chairman of the Division's Executive Committee, presided. C. A. Lee and C. E. Bowers, hydraulic engineers at the Navy's David Taylor Model Basin in Washington, D.C., collaborated on one, "Investigation of Ship Performance in Restricted Channels," detailing their model studies. J. E. Reeves and E. H. Bourquard, respectively the chief of division and chief of navigation section, Special Engineering Division, Panama Canal, co-authored another, "Design of Channel for a Sea-Level Canal," describing design methods for the proposed canal. The third paper, "Traffic and Capacity of the Panama Canal," by Ralph P. Johnson, Corps of Engineers, Little Rock, Ark., who formerly was chief of the route studies and reports branch of the Special Engineering Division, and Sydney O. Steinborn, engineer in charge of the Special Engineering Division's traffic studies, reported:

"In the year 2000, the average daily traffic would be 46 vessels; the peak-day traffic for which the canal should be designed is 69 vessels. By about 1960, the capacity of the present canal, during periods of lock overhaul, would be insufficient to accommodate traffic without undesirable delays on peak days."

While asserting that "with modifications, principally to eliminate the periodic need for closure of one of the twin locks for overhaul, the capacity or the present canal could be increased to meet all commercial requirements until the end of this century," the paper emphasized that "certain large naval and commercial vessels would be unable to transit the Canal," and only "the construction of new and larger locks or the conversion of the present canal to sea level would create sufficient capacity to handle all traffic until well beyond the year 2000."

It was brought out that a lock canal designed to meet the future needs of commerce and having the maximum security feasible in this type of canal would cost $2,307,686,000, but would still be deficient in resistance to modern weapons.

As depicted in the papers presented at the Waterways Division session, the sea-level canal would permit not only transit of vessels of any size likely to be built during the remainder of this century, but would permit two-way passage of vessels. Such passage would be possible in fog, which has been a severe handicap in the present canal.

Good Engineering Credited with Holding Down Mounting Power Production Costs

THE POWER DIVISION held two sessions, Friday morning and Friday afternoon, with Joel D. Justin, Philadelphia, chairman of the Division's Executive Committee presiding. The morning session was devoted to hearing two papers on cost trends in steam-electric and hydroelectric power generation. Edwin H. Krieg, consulting mechanical engineer, American Gas and Electric Corp., New York, and Milton G. Salzman, civil engineer, Ebasco Services, Inc., also of New York, prepared papers on cost trends at the morning session.

At the afternoon meeting James P. Growden, chief hydraulic engineer, Aluminum Co. of America, Pittsburgh, authored a paper, "The Nantahala Earth-Faced Rock-Fill Dam"; Donald J. Bleifuss, engineer with the Morrison-Knudsen Co., Inc., San Francisco, had a paper on "Diversion Tunnel and Power Conduit of Nantahala Hydroelectric Development," and Raymond E. Davis, director, Engineering Materials Laboratory, University of California, Berkeley, had a paper on "Rehabilitation of Barker Dam." See page 26.

Edwin H. Krieg

Mr. Krieg's paper, which discussed engineering methods of holding down initial and operating costs, summarized cost trends in steam-electric power generation as follows:

"Large increases in steam-electric plant investment and in cost of generating electricity by steam turbine-generators have followed World War II. Not only do cost indexes show that steam-electric plant costs have already increased some 63 percent, but operating costs have risen about 51 percent through increased fuel costs and higher wages for plant operators.

"Increased investment and operating costs can only be partly compensated for by reducing the controllable elements of investment and operating costs, and some examples of each are given.

"Briefly, the matter of cost of generating electricity stands:

"1. System investment costs have gone up some 57 percent.

"2. Operating costs have gone up some 51 percent.

"3. Taxes are almost 20 percent of gross operating revenue and approximate 1.5 times the fuel bill.

"4. Higher costs are likely to continue for some time, which means

materially lower earnings for utility companies. Reserve capacity to cover outages or unavailability of equipment is at an all-time low. This additional needed capacity and replacement of obsolete capacity must be made at current high costs. Such additional plant can only mean less output per kwhr and hence less earnings per dollar of investment for the new facilities.

"Present high costs make this a time, not for traditional rate reductions, but rather for the expending of all energy to make both ends meet with present tariffs. It is a time to follow costs closely for their effect on long-term planning and earnings. What will total earnings be five or ten years from now when the revenue on a $1,600 capital investment will only be that formerly received from $1,000.

"Cost of electricity has not increased in spite of rises in every component for producing it, but rather has helped to keep the price structure stabilized by contributing not a whit to the ascending spiral of prices. While this has been true in the past, it may not be possible to so continue in the face of unceasing pressure of price rises in other commodities. It may be necessary also to increase the price of electricity."

Milton G. Salzman

An 80 percent increase in the productivity of workers in privately owned electric light and power utilities, as against productivity of common and skilled labor which a recent survey found to be 36 percent under prewar standards, is a key factor in checking the rising trend of operating costs in hydroelectric plants, Mr. Salzman's paper stated. He discussed engineering techniques which may be credited with helping to offset the rising trend of labor and materials cost in construction of hydroelectric plants.

"Efficiency in design, construction and operation of new hydro plants must of necessity be the keynote if costs of generation are to be kept in bounds," he said.

Pointing out that the stepped-up postwar tempo of the nation's business has created a "dire necessity of obtaining the most readily available source of plant capacity to keep pace with the rapid and abnormal load growth on most power systems," Mr. Salzman listed labor and material prices as the principal uncontrollable items affecting both investment and production costs, and added, "There is no recourse but to accept the prevailing prices, as plants must be built and operated when needed."

Engineering matters, which he listed among controllable costs, are plant location, size of installation, number and type of units, plant layout, selection and suitability of equipment.

Threat of coal and transportation strikes to curtail steam production of electric power has given development of hydroelectric projects a new impetus, Mr. Salzman said, and sites which were formerly considered uneconomical, when compared to steam, are again being reviewed.

As an example of economies effected by skillful engineering, simplified and improved design and coordinated layout together with improved efficiency and increased output of plants, Mr. Salzman cited a recent extension to a hydro station in the Northwest. Through installation of an addition to the plant at a cost of about $58 per kw, the overall unit investment cost of the plant will be reduced from $148 to $103 per kw, he said.

Sea-Level Flood and Tidal Hazards Can Be Overcome, Hydraulicians Report

FLOODS AND TIDAL currents, deemed momentous hazards to shipping when a sea-level Panama Canal was considered early in the 20th century, can be rendered harmless by modern engineering if the proposal before Congress to convert the present lock-and-dam canal to a sea-level route is adopted as a means of meeting the threat of atomic-bomb attack.

Details of the hydraulic techniques involved were discussed before the Hydraulics Division of ASCE at one of two sessions held by that Division, by engineers authorized by Congress to make a postwar study of "means for increasing the capacity and security" of the Canal. They participated in a symposium on the Panama Canal, which was the theme of the meeting. Presiding at both meetings was Dr. Lorenz G. Straub, Minneapolis, chairman of the Division's Executive Committee.

Presenting papers were F. Steward Brown, Assoc. M. ASCE, of the Panama Canal Special Engineering Division, on "Flood Control for a Panama Sea-Level Canal," and Stuart Meyers and E. A. Schultz, both Associate Members ASCE, also of the Special Engineering Division, who collaborated on "Tidal Currents in a Panama Sea-Level Canal."

A plan of control was outlined by Mr. Brown "wherein 87 percent of the tributary area would be diverted directly to the Atlantic Ocean and an additional 4 percent would be controlled by retarding reservoirs."

"The control of floods on the tributaries would completely eliminate hazards to shipping from flood inflows and resultant cross currents," Mr. Brown said. "The system would have sufficient capacity to control flows well in excess of the largest flood that has occurred in 47 years of record."

Such dams as would be required for creating retarding reservoirs, he said, "would be virtually unbreachable by bombing of any type, and a breach in the levees would be of no consequence."

If breached, he said in contrasting damage that would result from bombing of the present lock-and-dam arrangement, "only minor remedial work would be needed to restore the system to effective operation."

In their paper, Messrs. Meyers and Schultz described the hydraulic model of the sea-level canal they used in part of their studies, at 1 to 100 undistorted scale, and discussed measurements of roughness utilized by them. They estimated a current of "about 4.5 knots, at the Atlantic end of the Canal, as the maximum that would be caused in an open sea-level canal by a tidal range of 20 ft in the Pacific Ocean," as against 2 ft in the Atlantic.

The second Hydraulics Division session consisted of a symposium on High-Velocity Flow in Open Channels, in which three papers were read. Arthur T. Ippen, Assoc. M. ASCE, Associate Professor of Hydraulics, Massachusetts Institute of Technology, Cambridge, Mass., presented a paper on "Supercritical Flow in Open-Channel Contractions." Robert T. Knapp, M. ASCE, Professor of Hydraulic Engineering, California Institute of Technology, Pasadena, had a paper on "Design of High-Velocity Curves." The third paper, "Open-Channel Expansions for Supercritical Flow," was by Hunter Rouse M. ASCE, Director, Iowa Institute of Hydraulic Research, State University of Iowa, Iowa City.

Pros and Cons of Toll Roads Discussed at Highway Division Meeting

"TOLL ROADS" were the subject of a panel discussion which occupied the entire session held by the Highway Division Friday morning. Presiding was Charles M. Upham, Washington, D.C., chairman of the Division's Executive Committee.

Papers were presented by Enoch R. Needles, M. ASCE, Consulting Engineer, Howard, Needles, Tammen and Bergendoff, New York, and H. S. Fairbank, Deputy Commissioner, Public Roads Administration, Washington, D.C. Panel leaders in the discussion were Joseph Barnett, Chief, Urban Road Division, Public Roads Administration; Charles M. Noble, New Jersey State Highway Engineer, Trenton; Walter H. Steel of New York, a partner in the Phiadelphia banking firm of Drexel and Co.; and R. E. Jorgensen, Deputy Commissioner and Chief Engineer, Connecticut State Highway Department.

Enoch R. Needles

Citing as notable examples of toll roads the George Washington Bridge, the Holland Tunnel, the Lincoln Tunnel, the Triborough Bridge and the Henry Hudson Parkway, among others, Mr. Needles said:

"There may be reason to question the wisdom of building a specific project as a toll project, but it is hoped that no engineer will propose that these bridges, tunnels and parkways or highways should not have been built as 'free' projects, since it is so clear that many of these major facilities would have been delayed indefinitely if they had had to await construction as 'free' projects. The service these facilities have provided in the New York Metropolitan area is almost beyond measure, and the indirect benefits to the community are undoubtedly the equivalent of the direct.

"The toll road or bridge or tunnel should be considered as a device for providing special transportation service under special conditions through payment of a special tax or toll. The collection of tolls in payment for special service or unusual accommodations in travel or transportation is not new, nor has the toll been considered an unfair or improper form of tax if the toll is clearly reasonable and the service wholly adequate and desirable but unattainable except on a special tax basis. No tax has ever been popular. There is no perfect tax. There have always been different theories on taxation. Recently, a very practical politician told me that the ideal tax was that tax which would produce the greatest return to the collector with least complaint from the public. As a taxpayer, I must confess that I want my taxpaying as painless as possible, whatever the device which lulls me to complacency.

"Now a toll is a tax. So no toll ever popular. It is endured only the service provided is clearly worth the fee collected, and as it is equally clear that an equivalent 'free' facility could not have been possible under any reasonable conception. Actually there is no such thing as a tax-free or a toll-free road. We all know this to be true. But we speak of the 'free road or the 'free bridge' as the one for which no *direct* service charge is collected as we travel over it.

"Fundamentally, our city streets are 'free.' But how free are they when restrictions begin to appear in behalf of 'the greater good to the greater number'? One-way streets, no trucking, slow, no parking—are these signs of 'freedom,' or simply devices for better service to the general public? The parking problem is not so universally complicated and burdensome that any arrangement which will take cars off the streets but provide convenient public parking for a modest toll is hailed as a notable step forward in municipal planning and administration.

"No toll highways should be built unless a comparable 'free' highway is clearly unattainable and unless it can be demonstrated to be self-supporting by competent authority. All toll highways should be publicly owned and should become 'free' and part of our state highway systems when they have paid for themselves."

Canal Slide Dangers Can Be Minimized, Soils Experts Report

DANGER FROM SLIDES, bane of construction and early operation days of the Panama Canal, can be minimized by modern engineering in the proposed conversion of the present lock-and-dam canal to a sea-level route virtually impregnable even to atomic bombing. In fact, special slope-design treatment, evolved in studies which included causes of slides so great that they closed the present canal to traffic as recently as 1931, can produce slopes which not only would be stable under static loading, but which would resist dynamic forces so effectively that "large explosions would not be expected to cause closure of the canal."

This was the gist of papers read before the Society's Soil Mechanics and Foundations Division by W. V. Binger, chief, Soils and Geology Branch, Missouri River Division, Corps of Engineers, Omaha, Nebr., formerly chief of the Soils and Foundations Section of the Panama Canal, and Thomas F. Thompson, chief of the Geology Section, The Panama Canal, who had a joint paper on "Excavation Slopes for an Improved Panama Canal"; and Dr. Arthur Casagrande and W. L. Shannon of Harvard University who, under contract with the special engineering committee of the Panama Canal, conducted tests of strength of soils under dynamic loads. The Harvard men collaborated on a paper describing their work on this project. Frank A. Marston, Boston, chairman of the Division's Executive Committee, presided at the session.

The papers pointed out that, although more than one billion cu yd of excavation will be required—about three times the volume of material removed in construction of the existing canal—slopes can be designed that would be secure from major slides such as those which earlier spasmodically closed the canal for several months at a time.

Dr. Casagrande and Mr. Shannon described apparatus developed and tests performed to investigate the strength of soils and soft rocks under dynamic loads and concluded: "From the tests performed on soils it can be concluded that their strength under transient loading is greater than their strength under static loading."

In their paper, Messrs. Binger and Thompson asserted that although the effects of large bomb explosions were

not taken into account in the development of slope-design standards, the Harvard University studies indicate that "sliding failures caused by dynamic loads on a statically safe slope would probably not result in closure of the canal, and flattening the slopes beyond the requirements for static stability, therefore, is not believed to be necessary."

The Soil Mechanics and Foundations Division had a second session, a joint meeting with the Air Transport Division, the program for which was arranged by the Committee on Airfield Foundations.

At this meeting of the two Divisions two papers were presented, one by Robert R. Philippe, Assoc. M. ASCE, Head Engineer, Ohio River Division Laboratories, Department of the Army, Corps of Engineers, Mariemont, Ohio, on "Full-Scale Research on the Design of Concrete Pavements and Their Foundations," and another by O. J. Porter, M. ASCE, consulting engineer, Sacramento, Calif., on "Vertical Sand Drains for Stabilization of Compressible Foundations."

Robert R. Philippe

Increasingly heavier aircraft make structural analysis essential in fixing the design of heavy-duty landing-field pavements in the interest of safety, Mr. Philippe said in a progress report on the investigations of rigid pavements that have been under way by the Corps of Engineers since October 1941.

"In the late thirties," Mr. Philippe said, "most highway and airport pavements were designed and selected without much regard to structural analysis. Experience indicated this procedure to be correct because wheel loads had not exceeded 15,000 lb, and the minimum thickness required for construction and durability satisfied many of the observations and attempted correlations. Conclusions drawn prior to this time are clouded by this basic condition."

Pointing out that some operators of airports have been inclined to minimize the importance of structural analysis advocated by engineers, Mr. Philippe asserted that the evidence gathered by the Corps of Engineers' study "indicates the need of structural analysis to fix the design of heavy-duty pavements." A more detailed account of Mr. Philippe's paper is presented in the article entitled, "Full-Scale Research Advances Design of Rigid Pavements for Heavy Wheel Loads," on page 32 of this issue.

Two Symposiums Are Conducted by Sanitary Engineering Division

TWO SYMPOSIUMS were conducted by the Sanitary Engineering Division, one Thursday morning and the other Thursday afternoon, with Dean Gordon M. Fair, of Harvard, chairman of the Division's Executive Committee, presiding. At the morning session, the symposium subject was "Operations of Authorities Concerned with the Sanitation of Rivers and Harbors." Participating were Warren J. Scott, M. ASCE, Director of the Bureau of Sanitary Engineering, Connecticut Department of Health, Hartford; Arthur D. Weston, M. ASCE, Director and Chief Engineer, Massachusetts Department of Health, Boston; Seth G. Hess, M. ASCE, Director and Chief Engineer, Interstate Sanitation Commission, New York; James H. Allen, M. ASCE, Executive Secretary, Interstate Commission on the Delaware River Basin, Philadelphia; and Robert N. Clark, M. ASCE, Chief Public Health Engineer, Tennessee Valley Authority, Chattanooga.

In their papers, these authors described the cooperative efforts of the various states and the federal government to control pollution in interstate streams. Emphasis was placed on the need for states to undertake sanitation work in cooperation with neighboring states.

Importance of local participation and cooperation was stressed in all the papers, including that presented by Mr. Clark, which concluded:

"There is a need to strengthen every component of state and local government, every local or regional industrial organization, every consulting engineer, who is attempting to reduce pollution. It does not strengthen any group for a federal agency to take over its functions. The more practical way is to facilitate a record of successful accomplishment, to build prestige, to bring to bear correlative groups or activities, and finally, as the local service is established, for the federal agency to withdraw as completely as possible, leaving a small organization adapted to meet its own situations and representing the people of the region."

The afternoon symposium, on "Sewage Disposal into Tidal Rivers and Estuaries," was comprised of papers by Karl R. Kennison, M. ASCE, Chief Engineer, Metropolitan District Commission, Commonwealth of Massachusetts, Boston; Richard H. Gould, M. ASCE, Director, Division of Engineering, Department of Public Works, New York; and a joint paper by Samuel S. Baxter, M. ASCE, and M. B. Tark, M. ASCE, who are, respectively, Assistant Chief Engineer and Associate Engineer of Design of the Philadelphia Public Works Department's Bureau of Engineering Surveys and Zones.

Richard H. Gould

New York's "other urgent needs" are holding up a $134,000,000 sewage treatment program, needed to cleanse waterways surrounding the city and to provide safe health conditions for bathing and other recreation, Mr. Gould asserted in his paper, read in his absence by Dr. Gail P. Edwards, of the New York City Department of Public Works. The city's program, already delayed by the war, makes "construction of additional major plants contingent on the ability of the city to provide funds in the face of other urgent needs and under statutory limitations that are now quite restrictive," the paper stated.

"The possibilities of financing the sewage work by special sewage charges has been seriously considered, but there appears to be no immediate prospect of early adoption of this method," Mr. Gould said.

Listing eight plants for which design is from 6 to 100 per cent complete, he said:

"Construction has been resumed on the 60 mgd 26th Ward Plant in Brooklyn, and bids are now being advertised for the first contract of the 160-mgd Owls Head plant, also in Brooklyn. Plans and specifications, in completed or partly completed stage, are available for construction work to the value of about $80,000,000."

Pointing out that while sewage treatment in what is now New York City started some 63 years ago, the program for modern plants started only 13 years ago, Mr. Gould' paper concluded:

"While there is still much to be done in New York and there are still many serious conditions to be corrected, the works now operating have done much to alleviate conditions in some areas and have permitted the advancement of many other worthwhile public improvements. It is believed that the city is becoming ever more conscious of the necessity of carrying on to completion the work of furnishing treatment to all sewage originating in the city."

The plants listed by Mr. Gould, together with their capacities, expressed in million gallons daily, are: Hunts Point, 120; Rockaway, 15; Owls Head, 160; Newtown Creek, 280; Port Richmond, 10; Wards Island Extension, 240; Bowery Bay Extension, 80; Oakwood Beach, 15; Red Hook, 40; Tottenville, 3; Fresh Kills, 5, and Bloomfield, 3.

Samuel S. Baxter and M. B. Tark

Progress in Philadelphia's 30-year sewage disposal battle was reported in this jointly prepared paper. Pointing out that prior to 1918 all of the sanitary and storm sewage of Philadelphia's 253-sq mile area was discharged into the Delaware and Schuylkill Rivers without treatment, the Philadelphians discussed the Northeast Works which now gives primary treatment to about 60 mgd, approximately 19 percent of the average dry-weather flow.

They listed as under way the following additions to plant: primary, aeration, and final sedimentation tanks, sludge digestion tanks and a water tank, together with mechanical equipment and electrical and pumping work for these facilities.

"Total work under contract at this time amounts to $7,000,000," the paper asserted. "Work started on May 5, 1947, and is proceeding slightly ahead of schedule. Contracts for the blower building and for miscellaneous work will be advertised in 1948. Present schedule calls for the plant to go into operation on September 1, 1949.

"Sites for two other treatment plants, the Southeast Works and the Southwest Works, have been acquired, and a pumping station has been built at the Southwest Works. Some of the intercepting sewers to serve these plants have been constructed, but no treatment facilities have been started. It is now planned to begin construction on these plants in 1949."

Clinical Analysis of Urban Growth Marks Meeting of City Planners

A CLINICAL ANALYSIS of urban growth occupied the attention of the City Planning Division at its session Friday afternoon. With Lawrence Sheridan, Indianapolis, member of the Division's Executive Committee, presiding and making the introductory remarks, four speakers participated in the analysis which preceded a general discussion.

The only woman on the Annual Meeting program, and one of the few ever to appear before the ASCE, was the first speaker at this session. She is Mabel L. Walker, Executive Director, Tax Institute, New York, who spoke on "What Are the Forces Determining Metropolitan Patterns?" Other speakers were: Robert F. Wagner, Jr., chairman, New York Planning Commission, whose subject was "Can Urban Redevelopment Save Our Cities?"; Hugh R. Pomeroy, director, Westchester County Planning Commission, White Plains, N. Y., who discussed "What Form Shall Urban Expansion Take?"; and Leslie Williams, New York consulting engineer and secretary of the ASCE City Planning Division's Executive Committee, who concluded the program by discussing "The Need for Comprehensive Planning."

Mabel L. Walker

City planners must plan the city for the people, and not the people for the city, Miss Walker said. "The individual is no longer a building block, as circumstances forced him to be during the 19th century when the hard economic facts of life forced more and more people to the city because that was where they could earn a living. The individual is the ultimate architect of the city. The decisions he makes as an individual, coupled with those he makes with his neighbors, will determine the city pattern of the future. The specialist can merely tag along, providing the technical know-how for the individual."

Miss Walker pointed out that transportation facilities largely determined the locations of cities in the first place, and attracted industries which, in turn, attracted the people.

"But he who giveth can also take away. Transportation helped to build our cities during the 19th century; transportation is helping to break them up during the 20th century. We are going to be forced to reconvert our cities, not because we think it will attract population and enhance land values, but because we need cities that are functionally adapted to the time in which we live."

Citing statistics showing population decline in cities, with largest decline in the larger cities, Miss Walker warned that this trend is no transitory matter. "There seems every likelihood," she said, "that this decentralization will proceed at a rapidly accelerating rate for at least a few decades when, perhaps, some approximate stability may be achieved, but at a far lower density than at present."

Scoring "experts who demand rather apoplectically whether we are going to permit the cities to empty out," Miss Walker asserted:

"Not permit, but help them decentralize, may be the appropriate reply. We shall be defeated if we try merely to patch up the cities along the lines of their present pattern. We must soberly evaluate past trends and future possibilities, and free our minds for a new approach. We cannot stop this outward flow. We can either impede it, and thereby make conditions in and around the city intolerable for a generation or so, or we can consciously and deliberately smooth the way for the decentralization to take place, realizing full well that we are to be temporarily accelerating it, but that by so doing, we shall make the inevitable adjustment more smoothly and more quickly."

Miss Walker depicted the city of the future as a fluid city, if properly planned, stating:

"Any way we look at it, traffic conditions are likely to be almost intolerable for the next decade or so, but if population trends are reasonably well appraised and transportation facilities developed commensurate to the need, we should evolve a much happier urban-rural pattern after a few years. If the city of the future is to have health and vitality, it must be possible for these great human tides to flow in and out easily and readily. The fluid city of the future will not be less expensive to maintain than the static city of the past. During the transitional years it will be far more expensive, because these old cities must be loosened up at their stiff old joints and elasticized in their hardened old arteries, and that is probably going to be a more costly process than building them in the first place."

Robert F. Wagner, Jr.

Urban redevelopment, to restore blighted areas, decrease juvenile delinquency and provide better health conditions, is a major task which "necessarily calls for an even greater degree of cooperation between private industry and government at all levels," Mr. Wagner declared.

Citing a slum clearance survey made by his U.S. Senator father, Mr. Wagner said preliminary results "shed additional light on the need for greater activity, particularly on the part of government, in the field of urban redevelopment."

Speaking of the questionnaire sent to governors of all states, mayors of cities with populations of 50,000 or more, and prominent individuals representative of the nation's business, civic and social life, Mr. Wagner said:

"There was virtually unanimous agreement among these persons as to the widespread existence of slums and blighted areas. Approximately 90 percent of those replying stated that private enterprise could not now, or in the foreseeable future, provide decent housing for the low-income families residing in the slums. Dissents from that position were few among all groups, including those directly connected with private home building and finance. An equally high percentage favored publicly assisted low-rent housing for families who cannot afford decent private housing.

"The mayors who replied to the questionnaire reported that low-income families have benefited greatly by the housing program and that it has operated efficiently. There is likewise agreement among them that as a result of the housing program, conditions of health and juvenile delinquency have been improved, and that publicly financed housing did not prove competitive with standard private housing. A large majority of the mayors reported that the costs of city services in the areas have been reduced and the neighboring real estate values increased as a result of these projects.

"In addition, there was widespread agreement as to the desirability of a program for clearance of slums and blighted areas, and for the redevelopment of cleared sites, privately or publicly, in accordance with community plans. In general, replies sounded a prevailing note of urgency for prompt and effective action by Congress to meet the housing shortage.

"However, the problem of redevelopment is not limited entirely to housing, although that is its most pressing manifestation. Urban planning necessarily involves consideration of every phase of urban living—trade and commerce, traffic and transit, industrial location, highways, parks, and schools, and, of course, the financial ability of the city to provide the necessary municipal facilities."

Mr. Wagner pointed out that, bearing in mind that dispersion of industry, as a defense measure against atomic attack, can be expected to contribute to the mass exodus from dense population centers which has been in progress in this country for some years, "we face today a new challenge and a new opportunity to uproot from the cities the slums and blight which have marred their development."

Engineering Administration of Marshall Plan Urged in Address by W. L. Batt

ENGINEERING ADMINISTRATION of the Marshall Plan to keep it unfettered by "the cheap and tawdry shackles of political bias" was advocated by William L. Batt, wartime vice-chairman of the War Production Board, in an address at the opening-day luncheon of the Annual Meeting.

"If the job of rehabilitating and modernizing European industry to the point where it can again produce is to be done, the engineer, and not the politician, must do it, for the engineer is not concerned with being re-elected but with efficiency and results," Mr. Batt said.

Mr. Batt, who has been President of SKF Industries, Inc., Philadelphia, for 25 years and spent six years in wartime service in Washington, called upon industries to lend engineers and production experts to the administrators of the European Recovery Program for duty abroad, and even "continue to pay their salaries." Mr. Batt is a member of the Department of State's Business Advisory Council, President Truman's Committee on Voluntary Foreign Aid, and Chairman of the Allocations Committee of American Overseas Aid. He has visited Europe four times in the last two years, twice on official missions.

Citing voluntary individual gifts to Europe since the end of World War II as "reliable indications that the American people favor aid to Europe with their hearts as well as their minds," Mr. Batt said all the evidence points toward a continuation of this private relief to Europe. Calling the bipartisan nature of the United States foregin policy one of its major bulwarks and complimenting responsible leaders of both parties for their efforts to maintain a united approach to major world problems, Mr. Batt warned:

"But now there is a most disquieting clamor even in this most partisan of political years. Some very vocal people are attempting not only to inject partisan politics into the consideration of very grave questions of foreign policy; they are also trying to tie political strings onto the whole European recovery program. Men in responsible positions, who should know better, have said that they would like to see us use the Marshall Plan as a bludgeon to club European nations into changing their forms of government or making sweeping changes in their governmental procedures.

"They share the distrust and distaste which most Americans fortunately have for forms of government based on varying degrees of state control of the individual. They forget, however, that nothing has so annoyed the men in the Kremlin as the Marshall Plan. The Communists opened the floodgates of their vast propaganda when the plan was first broached by Mr. Marshall at Harvard. They have reconstituted the Comintern and set up a special propaganda bureau to combat it. Their predominant theme is that the whole Marshall Plan is, in their nomenclature, 'a devilish and clever plot by the imperialist United States to usurp the sovereignty of European nations and to take over and control every country that participates in the plan.' To tie political strings to the Marshall Plan would simply be adding another loud instrument to this symphony of calculated discord."

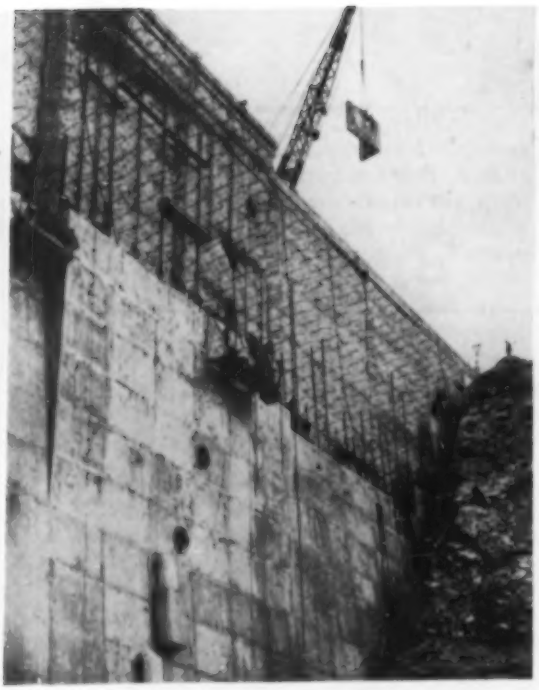
Calling the American engineer "the personification of what is referred to and admired around the world as 'American productive genius' or 'American know-how,'" Mr. Batt asserted:

"Whereas the ordinary run of American politician will inspire distrust when he attempts to guide the destinies of other nations, the American engineer is more fortunately regarded. His skill and knowledge are universally praised. The fact that our nation's political development has lagged far behind its economic growth proves this point and is at once apparent to the European.

"That is why I want to make a proposal to you engineers and, through you, to the diverse and important enterprises you represent.

"I believe that the heads of industries can benefit their own organiza-

(*Continued on page 86*)



LIGHT TRAVELING SCAFFOLDS facilitate work of taping and grouting joints of precast slabs erected as forms for protective blanket of concrete on face of Barker Dam. Two new 30-in.-dia hydraulically operated gates (near bottom of photo) and openings through slabs to which additional 30-in.-dia gates will be attached are part of gate-block construction. Crane lowers L-shaped slab for corner of gate-block section.

Grouted Gravel Fill and Precast Slabs Provide New Face for Barker Dam

RAYMOND E. DAVIS, M. ASCE, E. CLINTON JANSEN, M. ASCE., and W. T. NEELANDS

REHABILITATION OF THE badly disintegrated upstream face of Barker Dam, a 38-year-old, 175-ft-high concrete structure in Boulder County, Colo., involved the use of precast concrete slabs as forms in constructing a protective blanket of concrete varying in thickness from about 3 ft at the crest to about 8 ft at the base. The work was performed by the Prepakt Concrete Co. under terms of a contract with the Public Service Co. of Colorado. John Hofer was superintendent of construction. Engineering representatives of the Public Service Co. were E. Clinton Jansen, M. ASCE, hydraulic engineer, and L. B. Card, mechanical engineer. The plans and specifications were prepared by Raymond E. Davis, M. ASCE, consulting engineer and director of the Engineering Materials Laboratory, University of California, Berkeley. W. T. Neelands acted as resident engineer. Data presented herein, including techniques used in casting and erecting of precast slabs, the use of Prepakt concrete, grouting procedures, and comments on the insignificant form pressures and low temperatures observed, are abstracted from a paper presented before the Power Division at the ASCE Annual Meeting.

BARKER DAM, completed in 1910, is a gravity structure of cyclopean concrete having a maximum height of about 175 ft and a crest length of 720 ft. Its original volume was about 135,000 cu yd and its maximum thickness 124 ft. Located at an elevation of 8,200 ft, 17 miles west of Boulder, Colo., and about 20 miles east of the summit of the Rocky Mountains, the structure creates Barker Reservoir, which has a storage capacity of about 12,000 acre-ft. This water is the source of supply for the Boulder hydroplant, 12 miles downstream from the dam.

The reservoir is filled principally by the waters from melting snows during the spring and early summer, and is drawn down until it is nearly empty during the late winter and early spring, when the runoff of the drainage area is only a few second-feet. Because of the annual drawdown during the cold months, the upstream face was subjected to very severe conditions of freezing and thawing which, after 36 years, caused pronounced disintegration of the concrete at and near this face.

Originally the foundations were not grouted. Although the specifications provided for the possibility of foundation drainage by 2-ft-deep drill-holes at seams in the foundation rock, it can be assumed that only a very few such drains were actually installed.

After the dam was placed in service, pronounced leakage was observed through the foundation rock and there was considerable leakage through contraction joints which were without water stops. Also seepage occurred through horizontal construction joints. About 15 years ago an attempt was made to stop leakage by grouting through drill-holes in the abutment rock and in the dam itself, but a few years after the grouting was done, the leakage again became very pronounced. This condition pointed to the probability of the existence of large uplift pressures, not considered in the original design. For a full reservoir, considering uplift, analysis disclosed that according to our modern theories of design the dam was lacking in stability.

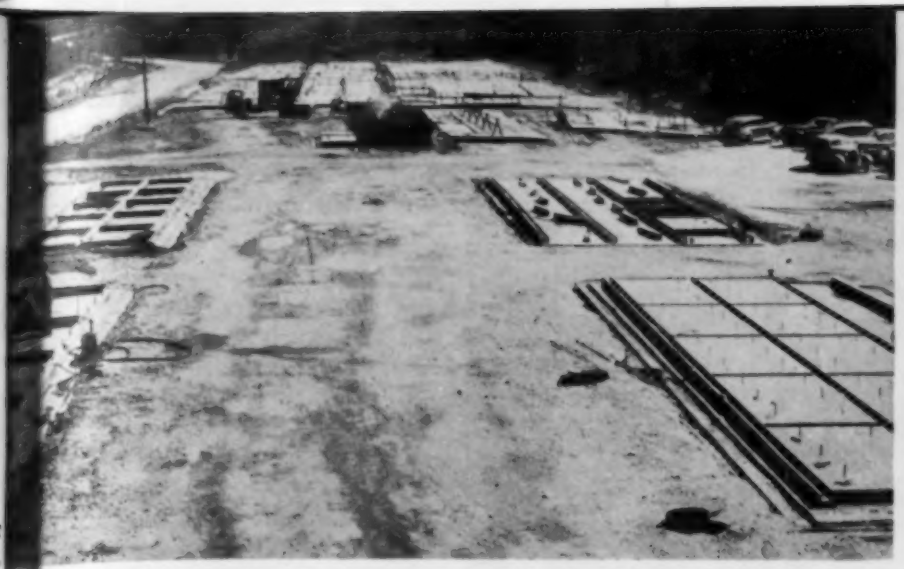
AS PART OF the Boulder Hydro Development, Barker Dam was constructed during the years 1908 to 1910 by the Eastern Colorado Power Co., a predecessor in interest of the Colorado Power Co. As a high-head peak plant, it forms today a valuable unit in what is known as the Central System of the Public Service Co. of Colorado. The hydro project is located in the canyon of Middle Boulder and Boulder Creeks in Boulder County, Colorado. Barker Dam is on Middle Boulder Creek. The capacity of Barker Reservoir is about 5,800 day-sec-ft, or about 15,000,000 kwhr at the powerhouse.

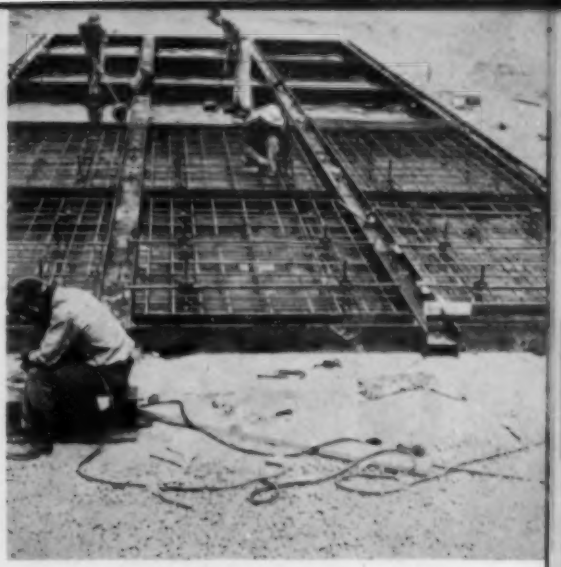
Rehabilitation Program

The work of rehabilitation consisted of deep and shallow foundation grouting at and near the upstream face of the old dam, the removal of all defective concrete from the upstream face of the dam, the addition to this face of a blanket of new concrete varying in thickness from about 3 ft at the crest to about 8 ft at the base, and the installation of a drainage system, composed of deep foundation drains and contraction-joint drains connected to a longitudinal drain within the addition to the upstream face. Two branches of the main longitudinal drain terminated at a transverse drainage tunnel cut through the base of the dam.

The unique features of the work are considered to be the drainage system and the methods employed in making the addition to the upstream face.

The addition was constructed by (1) erecting precast reinforced concrete slabs to act as forms over the entire upstream face, which slabs became a part of the permanent struc-





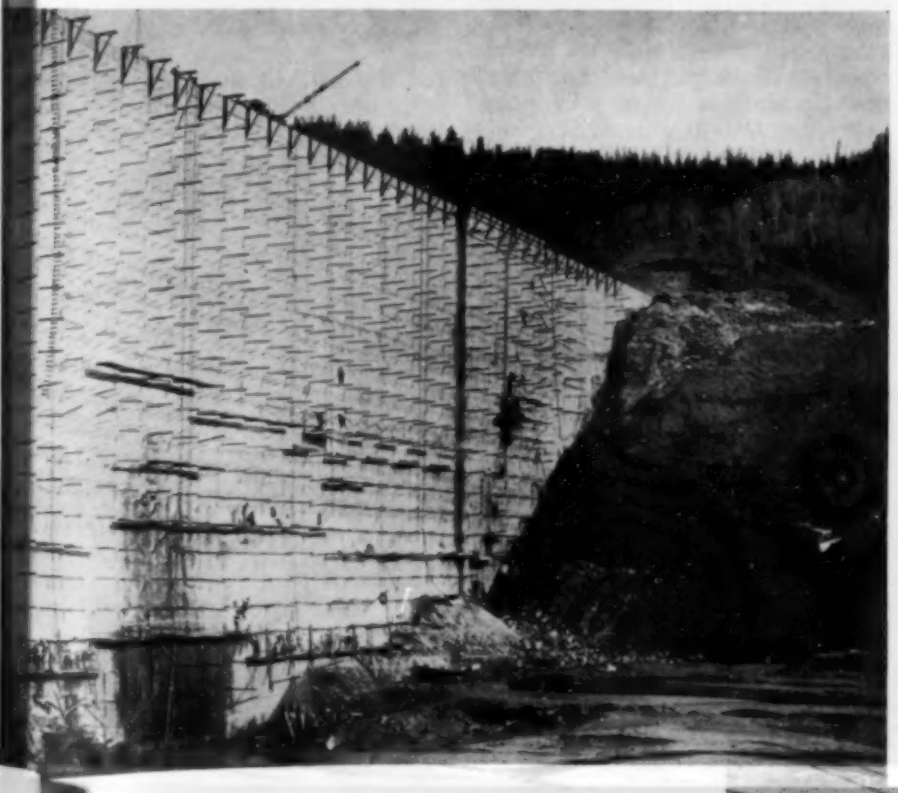
CASTING YARD (above, left) with 60-unit capacity produces 1,009 slabs needed in rehabilitation program. Slabs are moist cured for 14-day period and placed in storage yard seen in background of photo. Close-up view of concrete base (above, right) shows side forms in position and prefabricated mats of reinforcing bars in place. Steel dowels in downstream sides of slabs are later welded to anchor bars in face of dam. Base is mopped with oil (background) before concrete is poured. Water pressure applied beneath 4-ton slabs prevents formation of vacuum and aids lifting operation.

ture, (2) filling the space between these slabs and the upstream face with coarse aggregate, and (3) when the reservoir was nearly filled, grouting the mass of coarse aggregate from the bottom to the top as a continuous operation.

Materials

The aggregates for both Prepakt and conventional-concrete were processed from a deposit of sand and gravel about three miles upstream from the dam. For Prepakt concrete the sand was 0 to No. 16 and the coarse aggregate was $^5/_8$ to $4^1/_2$ in. Type II portland cement was specified for all the work. Alfesil, which is the trade name for a very finely divided siliceous material, was employed in all grout mixes for both foundation and Prepakt grouting. It was generally employed in the ratio of 2 parts portland cement to 1 of Alfesil. It possesses the property of combining with calcium hydroxide liberated during the process of hydration of the cement and therefore contributes to watertightness and long-continued gain in strength.

Intrusion Agent was likewise employed in all grout mixes. This is a proprietary compound which prevents early stiffening of grout mixes, reduces the water requirement for a given consistency, prevents agglomeration of cement particles, tends to hold the solids in suspension, and produces a grout which expands slightly before final setting takes place. For sand grouts employed in the intrusion of coarse aggregates to produce Prepakt concrete, Intrusion Agent is usually employed in the amount of about 1 percent of the combined weight of cement and Alfesil.



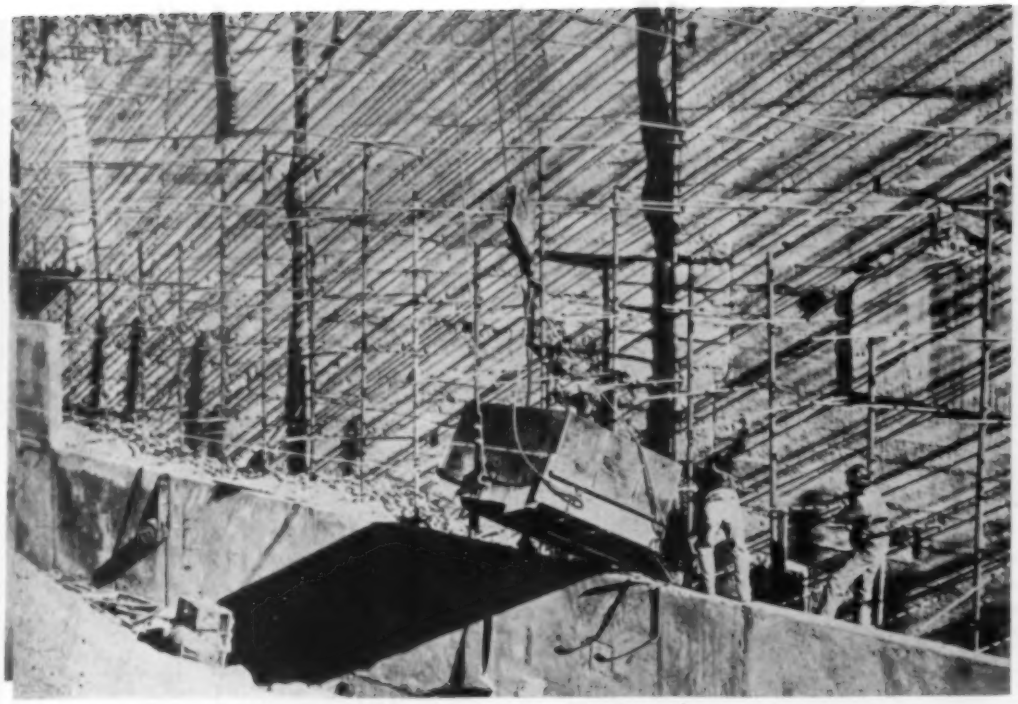
Foundation Grouting

Preliminary or shallow grouting was done in holes drilled 10 ft deep from the bottom of the foundation excavation at the upstream face of the old dam and were inclined 30 deg with the vertical under the upstream face. While these holes, designated as "B" holes, were usually spaced at 10-ft centers, occasionally they were placed as close as 3 ft.

Because of the badly fractured condition and generally poor quality of the rock immediately below the base of the old dam at the upstream face, additional shallow holes (not contemplated in the original program), designated as "D" holes, were drilled at an angle of 45 deg under the dam, the holes starting from points just above the contact between existing concrete and foundation rock. These holes were drilled to various depths, so that their lower ends would always be below the bottom of the trench excavated along the upstream face and hence above the top of the shallow grout holes which were started in the bottom of this trench.

Many of the 45-deg "D" holes, which were spaced on 4-ft centers, were found to be interconnected by underlying seams; by pumping water into one hole, mud and silt were frequently ejected from adjacent holes and from seams in the rock forming the downstream face of the trench.

WITH RESERVOIR EMPTY, and low-water flow of Boulder Creek passing through drainage tunnel below level of silt and water in foreground of picture, work progresses on chipping and sandblasting face of dam and setting of anchor bars. Scaffolding is held by ledger boards suspended from wire cables. Ledger boards are plainly seen in photo but anchor bars projecting from dam appear as light hairlines.



SKIP DEPOSITS AGGREGATE in forms near base of dam. Usually placement of slabs is kept well in advance of placement of aggregate. Sheet Neoprene (see roll in lower left-hand corner of photo) is cemented over joints on inside of slab opposite contraction joints in old dam. Opposite roll of Neoprene is vertical contraction joint in old dam with porous tile drain cemented in recess at joint. Vertical slotted pipes for grouting and inspection are embedded in aggregate mass.

Usually a group of several holes were grouped at one time after first being flushed until the returning water was clear. Both the "B" and "D" holes were grouted at low pressure with insert packers near the surface, always starting with the lowest hole in the group and working up towards the highest hole, so as to prevent water from being entrapped in the seams.

The purpose of grouting the shallow "B" holes was to close the seams near the surface in preparation for deep grouting at higher pressure. The purpose of grouting the "D" holes was to seal the contact between the existing dam and the underlying rock, which contact had not been well cleaned during the original construction, and to seal the rock seams below this contact surface and above the bottom of the foundation trench. The shallow grout holes of both "B" and "D" series were made by percussion drilling and were 2 in. in diameter.

Following the shallow grouting, deep grouting was done through diamond drill holes $1^3/_8$ in. in diameter, generally ranging from 40 to 60 ft in depth and spaced at intervals of 5 to 10 ft. These deep holes, designated as "A" holes, were inclined 6 deg upstream and generally normal to the rock profile. Stage grouting was done whenever the diamond-drill water ceased to return to the top of the hole and was apparently being lost through the seam. This was the condition for a good many of the holes.

Foundation Grout Mixture

The grout mixture usually employed was composed of two sacks of portland cement, one 100-lb sack of Alfesil, 3 lb of Intrusion Agent, and 20 to 30 gal of water, depending upon the tightness of the formation as indicated by the water test. Sometimes in tight rock formation, to increase the flowability of the grout, the quantity of Alfesil was doubled and the amount of intrusion agent was similarly increased. The grout pressures employed in the deep foundation grouting ranged from 75 psi for relatively open holes grouted in stages near the surface, to 300 psi for tight holes grouted in stages at greater depths.

A reciprocating grout pump of special design was employed for forcing the grout through a single hose line in each hole. Regardless of the length of the supply line, there was no return line; in other words, grout was not circulated to prevent clogging of the supply line as is the customary practice with straight portland-cement grouts. Without benefit of a circulating system, the pumps could be stopped for an hour or longer when any tendency towards plugging of the supply line occurred.

In spite of the relatively low water content of the grout as compared with the straight portland-cement grouts ordinarily employed for fo dation work, the ability of the gr to travel for long distances throu fine seams in the rock was quite r markable. On two occasions, gro flowed through seams beneath t structure, emerging through a se in a ledge of rock more than 100 downstream from the dam. Th hairline seams in the schist formati were found to be completely fill when additional rock was remove after grouting of the area.

Approximately 5,000 sacks of c ment and 125 tons of Alfesil we pumped into 4,900 ft of holes. Th effectiveness of the foundation grou ing was demonstrated in the spring 1947, when the flow through seams the abutments and beneath the da was observed to be but an insigni cant fraction of what it had been previous years.

Foundation Drainage

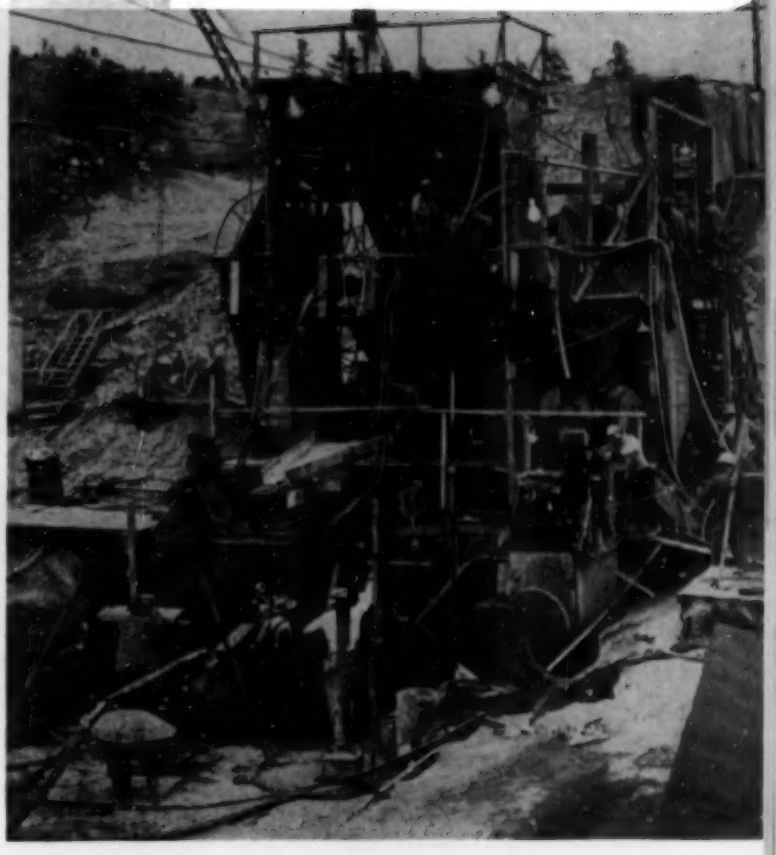
For foundation drainage the "C holes were spaced on 10-ft center and their depths varied from 30 to 4 ft. At the contraction joints in th old dam, which were on about 50-f centers, porous concrete drain-fi were placed in deep recesses with dr pack mortar. The upper ends of th contraction-joint drains were le open, so that at any time in the futur the drains might be flushed out.

The main longitudinal drain which were placed within the co crete of the stepped footings jus above the foundation rock, were c steel pipe in sizes varying from 18 in in diameter along the bottom to 8 in in diameter at the outer ends near th top of the dam.

The upper end of each of the tw branches of the main drain, whic terminate at an elevation 3 ft belo the crest of the spillway, wa equipped with an 8-in. gage valve intended for the occasional flushing of the main drain to remove solid that may accumulate in it. The lowe end of each of the branches of th main longitudinal drain terminate at the transverse drainage tunnel the upper end of which was plugge with Prepakt concrete prior to th construction of the footing for th addition. For control of the wate level within the mass of aggregate d the addition prior to grouting an during the grouting operation, a 12 in. valve was installed on the lowe end of each of the two branches of th main longitudinal drain within th tunnel immediately downstream from the tunnel plug.

Stepped Footings

The construction of a stepped footing of conventional concrete upon



BATCHING AND MIXING PLANT on north abutment of dam supplies grout for construction of Prepakt addition to dam. Sand is batched by weight from bin near top of picture. Cement and Alfesil are delivered in bags by gravity conveyor from storage to mixer. Two grout mixers of special design are employed—one as standby unit. Each mixer consists of two horizontal drums with 2-cu yd capacity arranged so that one drum can be charged while operations of mixing and discharging are taking place in other. Discharge material passes down chute to vibrating screen mounted directly over agitator storage tank.

hich the precast slabs were to be aced and upon which would rest e Prepakt addition to the upstream ce, was performed during the period October to December and followed osely the operations of foundation outing and drain installation. own the sides, where the steps were equent and at irregular intervals, ce forms were of lumber. Across e nearly level bottom, the face rms were principally precast slabs hich were left in place.

Along the base of the dam, where ecast slabs were used for forms, e joints between slabs which were line with the contraction joints in e old dam were sealed by strips of eoprene 8 in. wide and $^1/_{16}$ in. thick, mented to the inside face of the ab and covering the joint. These eoprene strips were ultimately carred as unbroken lengths up the side face of the precast slabs later be erected; they were designed to t as water-stops since it was conidered probable that contraction ints in the old dam would extend emselves in the form of vertical acks through the monolithic Prekt concrete blanket forming the dition to the upstream face.

Reasons for Using Prepakt Concrete and Precast Slabs

The reasons for selecting the Prekt method of construction for the dition to the upstream face deserve planation. If conventional conete had been employed, it would ve been impossible satisfactorily complete the work during the riod of emptying and refilling of e reservoir, since it would have en economically impracticable to rry on concrete operations during e severe winter months.

Also, it is regarded as impossible apply a relatively thin blanket new concrete to a relatively thick ass of old concrete having a subntially lower temperature than e new concrete without the subsequent development of severe cracks as the new and old concrete reach a state of temperature equilibrium. If such cracks develop, obviously the addition cannot act monolithically with the old structure.

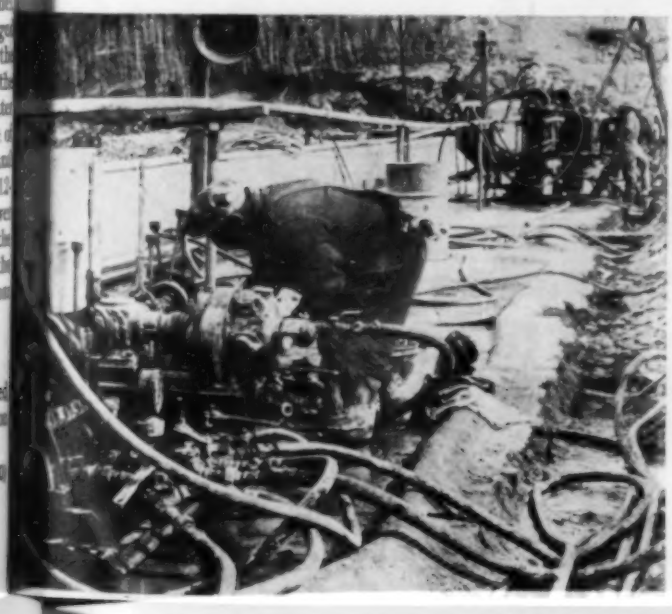
On the other hand, with the Prepakt method the precast slabs for forms and the coarse aggregate fill behind these forms could be readily placed during the winter months, regardless of low temperatures; the aggregate mass behind the slab could be grouted under water when the level of the reservoir was such as to produce the desired horizontal water load on the old dam, thus creating downstream deflection and minimum vertical compressive stresses at and near the upstream face; and grouting could be performed in a mass of aggregate which was of uniformly low temperature nearly equal to that of the cold water in the reservoir.

Results of investigations made by a number of laboratories also disclosed that Prepakt concrete of satisfactory strength and low permeability could be produced with a lower cement content than is commonly found necessary in conventional concrete. A low cement content was considered desirable in order that the temperature rise within the addition due to hydration of cement might be kept to a minimum, thus reducing the tendency toward cracking as the mass cooled.

Two other factors which influenced the selection of Prepakt concrete were its relatively low drying shrinkage (about half that of a corresponding conventional concrete) and its superior bond to old concrete (about 50 percent greater than the strength in bond between conventional new and old concrete).

Construction of Precast Slabs

Several factors influenced the decision to employ precast reinforced concrete slabs instead of wooden forms: (1) By employing a high-strength air-entrained concrete for the forms, great resistance to freezing and thawing could be obtained. This was considered to be a matter of importance under the conditions at Barker Dam, where the reservoir is drawn down during the winter months and freezing and thawing of concrete surfaces exposed to sunlight occur daily. With this outer shell of frost-resisting concrete, a low cement con-



SET OF TWO sled-mounted, air-driven triplex distributing pumps meter grout from main supply line through hose inserted in individual grout pipes. Twenty-one such pumps were employed. Mounted on short pipe columns is return line from which grout is discharged into small surge tanks—one for each triplex unit.

WATER IS RAISED to within 3 ft of top of parapet after grouting is completed and drainage system is in operation. Prepakt concrete is brought up to level of roadway on dam. Upstream parapet is of conventional concrete with precast slabs for both upstream and downstream faces. Downstream parapet, of old construction is repaired by chipping and covering with 3-in. minimum thickness of exposed Prepakt concrete. Roadway is new slab of conventional concrete applied after removal of 6 in. of partially disintegrated concrete from top of old structure. Concrete house in center of picture contains equipment for control of hydraulically operated sluice gates.

tent could safely be used for the Prepakt concrete between the old dam and the face slabs. (2) Lumber was scarce and seasoned lumber was unobtainable. To complete the work in the period between the emptying and the refilling of the reservoir, it would have been necessary to place the forms for substantially the entire upstream face a considerable time before grouting. Under these conditions, shrinkage and warpage of the forms would probably have caused openings of sufficient size to permit the escape of grout into the reservoir during the grouting operation. (3) Finally, it was estimated that timber forms of sufficient strength to safely carry the horizontal thrust produced by coarse aggregate placed to the full height of the dam would be more expensive than precast slabs.

Preparation of Upstream Face

The operations of chipping and sandblasting the upstream face and setting the anchor bars followed the receding water level in the reservoir. These operations were performed from hanging scaffolds which permitted work on any part of the face merely by shifting planks from one set of ledger boards to another.

More than 6,000 anchor-bar holes, 2 in. in diameter, were drilled in the upstream face of the dam to a depth of 3 ft. The holes were drilled on a downward incline of 10 deg, so that they could be completely filled with grout before the anchor bars were placed.

After drilling, the holes were cleaned with an air-water jet, and grout was injected from back to front, using a 1-in. hose which was gradually withdrawn as the hole was filled. Thereafter the anchor bars were inserted and gently tapped to insure their complete contact with the fresh grout. The grout was composed of one part portland cement to two parts fine sand, with sufficient aluminum powder added to produce about 5 percent expansion during the early setting period.

Proof testing of anchor bars was accomplished by applying a tensile load of 25,000 lb to each bar through a jack arrangement. No slippage was observed on any of the bars thus tested.

Erection of Precast Slabs

The precast slabs, generally $6^1/_2 \times 12$ ft by 8 in. thick, which served as forms for the addition to the upstream face, were placed during the winter and spring months, when for much of the time the weather was bitterly cold and winds of high velocity blew down the canyon. In spite of the generally bad working conditions, 1,009 face slabs with a total weight of 4,025 tons were set without a single accident. The daily rate of slab placement during an 8-hour shift increased with the experience of the crew and improvement in weather conditions. The maximum number of slabs placed in any one 8-hour day was 27, and the average number placed daily during the month of April was 15.

As the slabs arrived at the dam from the storage yard, they were lifted directly from the truck and swung into position on the face of the dam. Each slab was set on and against a metal spacer shim calculated to maintain the required elevation and stationing and to provide joint openings of suitable width for later grouting. Final positioning was usually accomplished within 4 minutes by two men working with crowbars while the crane maintained tension on the load line.

Anchor-bar welds selected at random were proof-tested by applying a tensile load of 25,000 lb.

After each course of slabs was erected, joint openings between slabs, which were generally about $^1/_8$ in. wide, were filled with an air-entrained grout composed of two parts cement to one part Alfesil. The grout was retained on the upstream face of the slab joints by 3-in.-wide muslin strips cemented to the concrete with Duco cement, and on the downstream face by a stiff mortar worked into the joints some time before the grouting operation was started.

The coarse aggregate for the Prepakt addition was placed by means of 4 cu yd skip and truck crane.

Generally the erection of slabs was kept considerably in advance of the placement of aggregate, so that it was necessary to drop the aggregate for some distance into the forms. To prevent segregation and breakage, planks were placed across the anchor bars so as to form a rock ladder. In this manner, excellent distribution of particle sizes was achieved. As the course aggregate was built up in the forms, strain-meter observations were made from which stresses in the anchor bars and form pressures were calculated.

Grouting of Prepakt Addition

To maintain the desired water level in a mass of ungrouted Prepakt aggregate behind the face slabs as the water in the reservoir rose it was necessary to prevent flow of water through the drainage system. Under these conditions, the foundation drains were of course totally ineffective in preventing the development of uplift pressures, and up until the time of grouting the assemblage of slabs and the mass of aggregate behind them would have an unknown and possibly negligible effect in so far as the stability of the structure was concerned.

Because of these conditions, it was considered necessary to start the grouting operation prior to the complete filling of the reservoir, and a water elevation 10 ft below the crest of the spillway was fixed as the maximum permissible before grouting was

gun. It was desired that the water vel be nearly at this elevation at the art of the grouting operation so that e dam would be deflected downeam and that the vertical compresve stresses at the upstream face ould be small. It was calculated at, with drains closed, the water vel in the reservoir might be pertted with safety to reach the crest the spillway at the time of completon of grouting.

Because of the uncertainty of a ntinued runoff sufficient to comletely fill the reservoir and because the great value of the water held in orage, it was required that no water wasted until the reservoir was led. Grouting, which was started hen the water in the reservoir was ft below the crest of the spillway, roceeded continuously except for ort interruptions until the entire ass of the addition from the bottom the top of the dam had been routed—in a period of only 10 days. he water level in the reservoir eached the crest of the spillway one our before grouting was completed. uring the 10-day grouting period ore than 4,000 cu yd of grout was truded into the coarse aggregate of he addition, thus producing 13,000 cu d of Prepakt concrete.

Grouting Plant

The grouting plant was quite nique. It consisted of a batching nd mixing plant erected on the north butment, a main pumping plant at he north end of the dam, a main supply line running along the crest of the dam for its full length with a return line back to the main pumping plant, and a series of small distributing pumps mounted along the roadway to which were connected hoses that were inserted in the 2-in. vertical slotted grout pipes previously placed in the coarse aggregate of the addition.

From the mixer the grout was discharged into an agitator storage tank, whence it was pumped by the main pump through the 3-in. supply pipe to the south end of the dam and back through a return pipe which decreased in size in steps from 3-in. to $1^1/_4$-in. diameter. At intervals along the return line were located valves for filling small surge tanks, each connected to the intake of one of the small distributing pump stations along the roadway. The return line brought back to the storage agitator tank all grout not taken by the small pumps.

The distributing pumps were small triplex units with a single discharge from each cylinder. As the pumping operation was started, hose from these connections were inserted to the full depth of alternate grout pipes on 8-ft centers and were gradually withdrawn—always keeping the lower end below the grout level as the work progressed.

The vertical pipes into which no hose was inserted, termed "inspection pipes," were employed to determine the grout level at frequent intervals. The rate of pumping at any location was controlled in this way. The inspection pipes were also employed for determining the temperature of the grout at and near its surface, the level of the water within the mass of ungrouted aggregate, and the temperature of the water immediately above the grout level.

Grout materials were proportioned as follows: 2 sacks of cement, 100 lb of Alfesil, 3 lb of Intrusion Agent, 300 lb of sand, and about 16 gal of water. In order that the initial temperature of the grout might be low, the water supply was obtained by pumping from the reservoir with the intake of the pump at a level where the temperature was about 43 deg F. The average temperature of the grout as it left the mixer was about 57 deg F.

Form Pressures

The stresses in 44 anchor bars to which Carlson strain meters were attached were calculated, and the pressures against the slab form, during the process of filling with aggregate and the later process of grouting, were determined. In general, the lateral forces produced by the aggregate were considerably greater than those which might be expected from a granular material placed without vibration, and the variations in pressure, as indicated by different meters, were large. Not infrequently the maximum lateral force was produced when there was only a few feet of aggregate above the meter. In such cases the pressure usually decreased with further additions of aggregate.

(*Continued on page 84*)

Radio-Telephone Enters Heavy Construction Field

OFFICE-TO-TRUCK COMMUNICATION (left) by two-way FM radio-telephone with 25-mile range saves time and money for excavator and grading company whose work requires quick assignment and equipment transfer, often involving changed instructions en route. As job is finished, tractor-trailer (right) of George J. Igel & Co., Inc., Columbus, Ohio, is ordered by radio-telephone to move backhoe to next site. Procedure permits company to get most efficient use out of its 17 pieces of excavating equipment. Receiver installed below instrument panel has selector to divert calls to particular vehicle, with signal often attached to horn in case driver is out of cab. Radio-telephones are also being used for auto-repair work in quick response to breakdown calls on congested arteries or long bridges, thus reducing delays and traffic snarls.

HEAVIER WHEEL LOADS emphasize importance of structural design for rigid pavements. Graders and sheepsfoot rollers prepare fill for extension of runways at Patterson Field, Dayton, Ohio. Project involves handling approximately 859,000 cu yd of excavation and borrow in constructing runway for B36 aircraft, world's largest land-based bombers.

Full-Scale Research Advances

Design of Rigid Pavements For Heavy Wheel Loads

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PROGRESS IS REPORTED herein on the investigations of rigid pavements conducted by the Corps of Engineers, Department of the Army, from October 1941 to the present time. In that period nine accelerated traffic tests on full-scale installations have been conducted, three on existing pavements, and six on prepared test sections. Wheel or wheel-group loads ranging from 20,000 to 150,000 lb have been used on appropriate pavements 5 to 24 in. thick. These studies include considerations of checking existing theories under idealized conditions, design requirements for single-wheel traffic loading, the effect of multiple-wheel-group loadings, overlaid or "beefed-up" pavements, base course, joint transfer, slab size, reinforcement, thermal and seasonal stresses and creep. This article is based on a paper presented before the Soil Mechanics and Foundations Division at the ASCE Annual Meeting.

IN THE LATE THIRTIES, most highway and airport pavements were designed and selected without much regard to structural analysis. Experience indicated this procedure to be correct because wheel loads had not exceeded 15,000 lb and the minimum thickness required for construction and durability satisfied structural design requirements. Many observations, attempted correlations and conclusions, drawn prior to this time, are clouded by this condition. The development and use of heavier aircraft loadings now demand structural analysis. Nonetheless, there are still those who believe that a nominal thickness of well constructed concrete pavement is sufficient for any applied load.

IN ADDITION to these full-scale studies, simultaneous investigations on the effect of impact, traffic distribution, vibrations, rocket and jet blast have been completed, together with airport pavement performance observations through periodic condition surveys of existing airfields, and the detailed examination of all reported failures. Supplementary information is being gleaned by detailed examinations of the physical properties of materials and the use of models. All this information serves to improve the design of rigid pavements and the alighting gear of aircraft, thus bettering the performance of airfields.

A statement made by a superintendent of airports for the Civil Aeronautics Administration at the Phoenix meeting of the ASCE provides an excellent example of this attitude: "This mumbo-jumbo of the past few years about high wheel loadings, repetition of load, optimum moisture, liquid limit, plasticity index and compaction every time we want to build a simple...facility is all right up to a certain point...." Although it is not the writer's purpose to take issue with this statement, it serves as a reminder that the need for structural design had better be demonstrated.

Two of many available examples are probably sufficient for this demonstration—a destructive, full-scale traffic test and a well-evaluated performance record. Figure 1 illustrates the disastrous result of subjecting a 6- and 8-in. concrete slab pavement at Lockbourne No. 1 Air Base near Columbus, Ohio, to traffic of a 37,000-lb wheel load.

Table I summarizes the results of crack surveys of three runways at the Vandalia, Ohio, airport, an outstanding example of pavement reaction and destruction under increasing wheel loads. Unfortunately this example is far too typical of what is happening to many of our airfields today.

Even these two selected examples

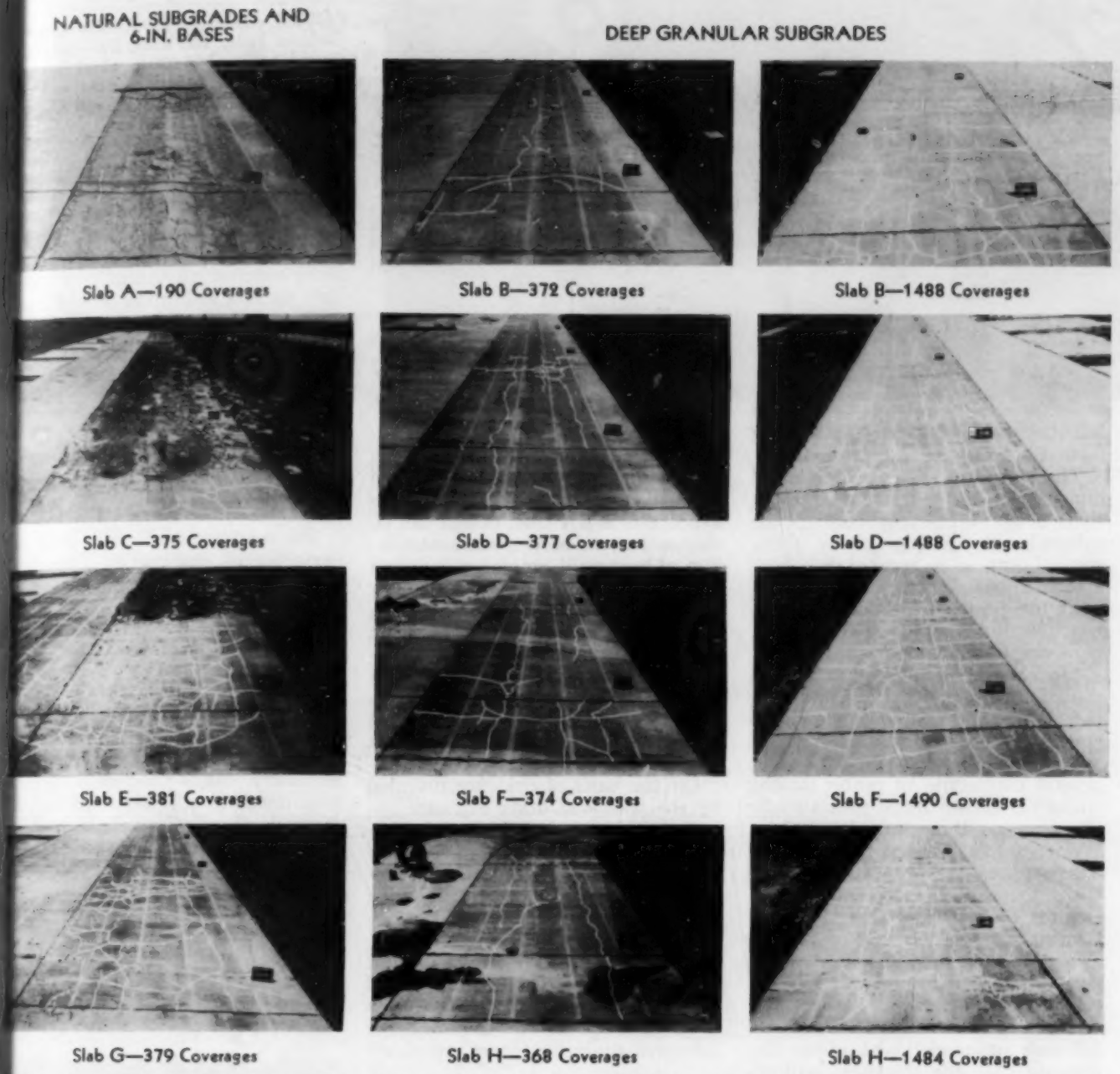

FIG. 1. SERVICE BEHAVIOR of 6- and 8-in. plain concrete slabs under 37,000-lb wheel load traffic is studied at Lockbourne No. 1 Air Base near Columbus, Ohio, to determine efficacy of base course. Tests show that when base course is used on less rigid subgrade, and rigid pavement is overloaded to cause serious failure, later traffic causes more rapid destruction than same pavement without base course.

indicate the absolute need of structural analysis to fix the design of heavy-duty pavements. Lest anyone should be lulled into believing that it always takes time for failures to develop, Fig. 2 is included to show the breakthrough that occurred after parking a 150,000-lb wheel load on a 9-in. concrete pavement for only a few minutes.

Verification of Theory

In 1941, the only theory available for application to such a problem was that developed by H. M. Westergaard, M. ASCE, later published in the April 1942 PROCEEDINGS of ASCE. The Portland Cement Association originally published this theory modified by Westergaard to conform to the results of the Arlington load tests for use in the design of highways. It was found, however, that the correction so determined resulted in a disproportionate reduction in requirements when applied to heavy aircraft wheel loads.

This analysis applies only to center loading, in contrast to edge and corner loading, and references to it herein are to the form given in the April 1942 PROCEEDINGS paper. In the May 1947 PROCEEDINGS of ASCE, Westergaard published new formulas for stresses in concrete pavements based on an analysis of the edge condition, and in this form it is used for comparisons.

Since 1941 a series of static loading tests on full-scale concrete slabs have been conducted on thicknesses varying from 6 to 24 in. These tests started in October 1941 at Wright Field, Ohio, and continued there through 1942; they started again in the summer of 1944 at the Lockbourne Army Air Base near Columbus, Ohio, and are still continuing there. The conditions surrounding these tests simulate, as closely as practicable, the conditions assumed by the theory,

FAILURE OF 5-IN. CONCRETE apron at Godman Field, Fort Knox, Ky.—caused by limited traffic of 26,000-lb wheel load—results in disintegrated pavement and displaced subgrade. Note upheaval of slab at left edge of failure.

but the practical limitations bring forth the following exceptions:

The slabs are of finite horizontal dimensions; the concrete used in the slabs is not necessarily elastic; the subgrade soil is not necessarily stress-strain linear in a vertical direction; and the loaded area simulates aircraft tire prints. In addition, time, which is not a factor in the theory, is proving to be an important variable.

Models embodying the same conditions are also under study, and since both model and field tests show similar tendencies, a few model results are summarized in Fig. 3. The general magnitude of center loading stresses is shown to be substantially the same as those calculated from Westergaard's Theory, whereas the edge stresses are proportionally less than theoretical. Recently Prof. Gerald Pickett and the Portland Cement Association has developed a solution for a solid subgrade, which gives promise of ironing out some of these discrepancies.

The above-mentioned studies of full-scale and model slab loadings also indicate that the thickness requirements of edges and corners of slabs control the design of slabs. This fact is well verified by traffic tests and experience. The rational design of pavements will be in question just so long as theory and measurement are in conflict. However Fig. 3 does show similarity in stress distribution even though the absolute value of each is in question. The value of this similarity is now being stretched to its limit when it is used as an excuse for interpolation and extrapolation of traffic test results. For the moment it remains the weakest link in the analysis.

A discussion of the effect of traffic on the validity of application of any theoretical analysis can well begin with the statement of a hypothesis. If the initial theoretical boundaries are allowed to deteriorate progressively in any fashion or degree with repeated loadings due to traffic, then the pavement must fail. If this hypothesis is not true, design can be only a matter of empirical correlation, at least until our ability to reason is vastly expanded. On the other hand if this hypothesis is true, a working theoretical analysis is within reason. The acceptance of this hypothesis does more than that, however, for it implies two criteria of design; one based on safe working stresses of concrete, the other on a limit of strain repetition of soil.

On the basis of evidence revealed by the tests and other evidence observed it is concluded that the hypothesis, as stated, is correct. The significance of its acceptance is twofold: it enhances orderly thinking as to causes of failure, and it requires the establishment of an additional criteria, based on strain-limit properties of soil, for design of rigid pavements. Such criteria have been developed, but are now the subject of intensive study for future report.

Tentative Design Requirements

Even though these criteria are not set, the acceptance of this hypothesis has influenced our thinking in setting tentative standards for pavement design. It must be stated further that this general program of investigations and observations, extensive as it is, yields very few pin-pointed results. The maximum obtainable from the nine full-scale traffic tests conducted is seven points with which to help fix a family of design requirement curves. Observations of pavement performance yield very little general design information in less than ten years. Even that information tends to fall into three groups—pavements grossly overloaded which break up rapidly, pavements properly designed for wheel loads in use, and pavements designed for wheel loads greater than those in use.

Of the 600 or more airfields observed by the Corps of Engineers in the United States, at least 350 have some concrete pavement. Of these only six now fall in the second group and one only has reacted under traffic sufficiently to yield positive information. Strangely enough this airfield is the Lockbourne Army Air Base, where so many of our investigations have been concentrated. Needless to say, all these observations have added much in the way of detailed knowledge of pavement performance.

The results of both traffic tests and performance observation have been used to adjust theoretical design requirements. These are shown in Fig. 4 in the form in which they appear in the Engineering Manual for Department of the Army Construction, Part XII, Chapter 3, May 1946. The requirements are being rescrutinized in the light of newly developed information, and adjustments will be made if necessary. How then are these basic requirements to be modified by such factors as base course, joint transfer, reinforcement, temperature stresses, overlay design and multiple-wheel gear? This question will be answered by a summary discussion of the effect of each of these factors as observed.

Base Courses

This discussion of the structural effects of the base course exclud

FIG. 2. BREAK IN 9-IN.-THICK CONCRETE pavement is caused by 150,000-lb wheel load of test rig. Break-through occurring in matter of minutes indicates that such failures do not always require great amount of time to develop.

TABLE I. PERFORMANCE RECORD OF DAYTON MUNICIPAL AIRPORT

NE-SW, E-W, and NW-SE Runways

Date of Survey	Number of Pavement Breaks				Max. Gross Operating Load
	Diagonal	Corner	Shatter	Total	
[illegible] 1942	0	22	0	22	18,000 to 26,000
[illegible] 1943	6	38	11	55	25,000 to 37,000
[illegible] 1945	471	624	205	1,300	58,000 to 76,000*

* Loading started spring of 1944.
† In service since December 1936. Design 7-5-7. No base.

quirements for frost control, pumping preventatives and construction expedients such as building a work platform in adverse weather. The value of a base course in highway design has been in dispute for many years, and a great deal of conflicting evidence has been used in support of either its inclusion or omission. The advent of heavier wheel loads, having brought with it prime requirements of structural design instead of durability of construction, also helps to clarify the base-course problem. It was thought, as the result of the first static loading tests, that granular base courses gave great structural benefits.

For example, the early Wright Field tests showed that an 18-in. gravel base course doubled to tripled the ultimate bearing capacity of 6-, 8- and 10-in. concrete pavements in center loading. This optimism was short lived, however, for subsequent traffic and repeated static loading tests showed these structural benefits to be very small and generally uneconomical. What is more, traffic tests revealed a more significant danger, which once revealed becomes axiomatic. Without exception, when a base course has been used on a less rigid subgrade in supporting a rigid pavement, and that pavement has been overloaded so as to cause serious partial failure, subsequent traffic on that pavement causes much more rapid destruction than it would on the same pavement without a base course. In support of this evidence, reference is made to Fig. 1 and the view designated "Slab E." In the foreground appears a 6-in. concrete slab placed directly on a lean clay subgrade cracked but passable after 381 coverages. In the background are 6-in. slabs on 6-in. base courses impassable even though patched after 5 coverages. These are shown to better advantage in the view designated "Slab C."

The same tendency was observed at Lockbourne No. 2, where 15-in. slabs reacted better under a 150,000-lb wheel loading than did the same slabs on a 15-in. base. This effect has also been observed on numerous airfields in operation. In addition, repetitious static loading tests on slabs with a base course produced erratic results.

In the light of the above facts and particularly considering the uncertainty as to future aircraft wheel loads it is concluded that the use of a base course should be discouraged for airfield pavement. If a base course is necessary because of frost, pumping or construction, other than cohesionless types are suggested.

Reinforcement Proved Uneconomical

Reinforcement produces distinct structural benefits, but within the scope of the writer's observations its use has proved uneconomical. Results with 37,000-lb wheel loads indicate that the use of 91-lb mesh in an 8-in. slab, top only, provides greater lasting qualities than does 12 in. of base course under the same slab. Use of 159-lb mesh in 8-in. slab produces even better results, but not as good as a plain 10-in. slab. From the viewpoint of cost, the latter is usually the cheaper. These and subsequent tests on Lockbourne No. 2 indicate a general increase in structural benefits with an increased quantity of steel. However, the increased benefits do not keep abreast of the increase in cost, with the result that the favorable effect of using increased steel rapidly vanishes.

Many designers, the writer among them, look with favor on the lasting qualities a nominal amount of steel will supply and usually provide for its inclusion in design to retard the spread of accidental cracks. This procedure is doubly sound in view of the unsettled state of future aircraft loads. If these loadings do increase in the future, and they probably will, the use of truss-like concrete slabs with structural steel top and bottom, well separated, offers attractive possibilities for a solution. Even now, this type of construction is being investigated.

Joints and Joint Transfer Devices

There is no subject related to rigid-pavement design more controversial than that of joints and joint transfer devices. Therefore this subject received major attention in our investigational program. Eighteen types of joints were included in Lockbourne No. 2, 17 for test. Eleven types were included in Lockbourne No. 1. In addition, exhaustive field performance, theoretical and model studies have been conducted.

Between joint types an ascending order of acceptability is discernible as follows: keyed construction, free, expansion, doweled construction and dummy groove. Free joints should never be used; keyed construction joints are very objectionable, expansion joints should be avoided if possible; the remainder are better. Although detectable differences were

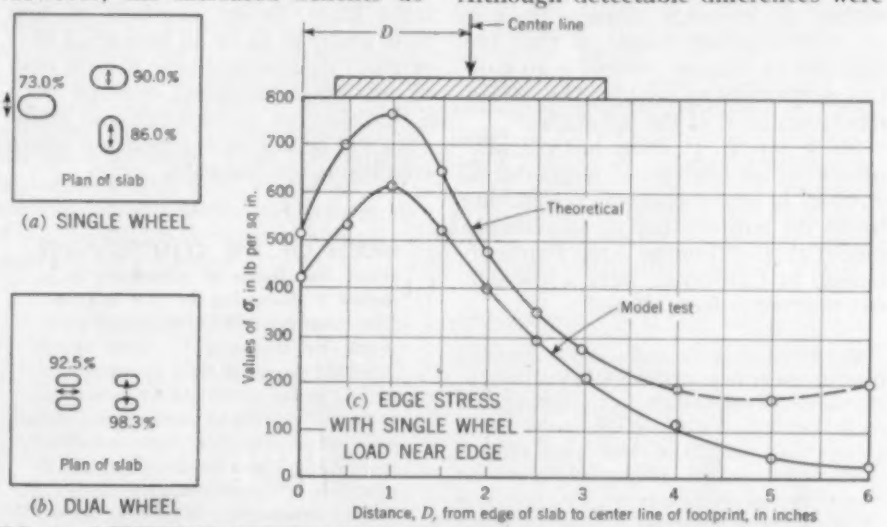

FIG. 3. AGREEMENT BETWEEN THEORY and actual measurement has been good for center loading, but theory indicates consistently higher stresses for edge loading than those measured. Deformations are also found in reasonable agreement for center loads, but theory indicates greater edge deformations than measured. Numerals in parts (*a*) and (*b*) indicate percentage of experimental stress to theoretical stress. Arrows indicate direction of stress. Diagram (*c*) gives comparison of model test stresses with Westergaard theoretical stresses.

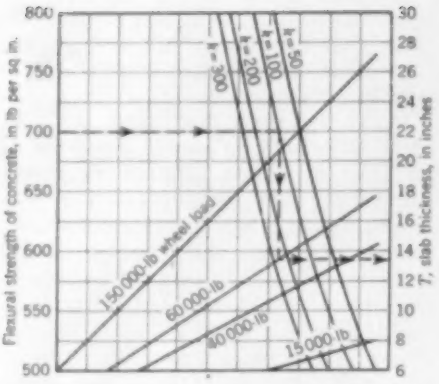

FIG. 4. PAVEMENT DESIGN CURVES for runways, as they appear in Engineering Manual for Department of the Army, are being studied in light of new information. Slab thickness of T = 13.3 in. is found for concrete with flexural strength of 700 psi, subgrade modulus k = 100, and wheel load = 60,000 lb, by following dotted line.

measured for the different types of joint-transfer devices tested, there was no effective difference in the over-all results.

If conclusions are to be drawn from limited results, it can be stated in general that the performance of a pavement is unaffected by the design of transfer devices except for keyed joints, which are generally unsatisfactory. Also, an adequate pavement is not appreciably weakened by weaker devices, and an inadequate pavement is not strengthened by stronger devices. This statement appears to be incongruous, particularly if it is judged in view of existing theories. These theories, however, are predicated on the control of stress within the concrete, whereas there is an ever-mounting suspicion that the function of transfer devices is to control deformations within the strain repetition limit of the subgrade.

Since Mr. E. P. Bone has recently presented an analysis of temperature stresses in heavy concrete pavements based on temperature measurements made at Lockbourne and Fairfield-Suisun in California, only a few salient points are here offered:

1. Based on long and continuous temperature recordings at different elevations in the slab and in the subgrade, the assumption of linear temperature gradients in slabs greater than about 8 in. thick is not valid.

2. Based on joint-opening measurements over a period of two years, the joints of thick pavements without expansion joints remained closed in the hotter part of the year (in Ohio, June to October), at which time the slabs were in horizontal compression.

3. In such a slab system this horizontal compression balances or overcomes the tensile stresses due to daily variations during the summer season. This is indicated by comparative deformation measurements.

4. The critical temperature stresses occur in the cooler part of the year, probably in the spring or fall.

5. Calculations based on temperature measurements in thick slabs and the thermal coefficient of expansion of concrete indicate that these stresses are less than 100 psi.

It is suggested therefore that when non-expansive aggregates are used in concrete, expansion joints be omitted in thicker slabs.

Overlay Performance

The problem of structurally improving or "beefing up" an inadequate pavement has received considerable attention both in performance observation tests and in analyses. The existing concrete slab was reinforced by placing another rigid slab immediately on top of it at Fort Wayne, Ind., at Bowman Field, Ky., and at Lockbourne No. 1 and No. 2. Although this type of treatment gave satisfactory performance, its application has been discarded in favor of non-rigid types of overlay. It has been found, by full-scale tests at McDill Field, Fla., Maxwell Field, Ala., and Lockbourne No. 3, Ohio, that treatments of as little as 3 in. of asphaltic concrete give astounding structural benefits.

These unexpected benefits were also indicated by the Hamilton Field, California, test, where a three-layered system—rigid slabs, 9 to 15 in. thick on top and 6 in. on the bottom, separated by 5 to 22 in. of less rigid material such as crushed stone or asphaltic concrete—produced very good over-all results. Accelerated traffic tests have shown overlays of less rigid material to be so beneficial that original designs utilizing a rigid slab of moderate thickness covered with a flexible-type surface can and probably will be in cost competition where conditions are favorable.

MUCH OF THE CONTROVERSY about the design of pavements is in reality a discussion of the question, "For what considerations should pavements be designed?" Until recent years the design of rigid pavements for highways was controlled by considerations of durability of concrete and construction requirements. Increased wheel loads have shifted the design control to structural considerations, particularly for airfield pavements. What then are the future loads for which present-day pavements should be designed? The most logical agencies for prognostication, the aircraft designer, manufacturer and operator, indicate that we are but entering an era of bigger and better aircraft.

In an attempt to reduce the pavement requirements for heavier aircraft, pavement designers are exerting all possible pressure on aircraft designers to use multiple-wheel gear. This is done on the assumption that dividing the load into more points of application will be beneficial. The success of these efforts is indicated by the changing of the main gear of the B-36, so that the nominal 150,000-lb load transmitted by one 110-in. dia. tire is now applied by four 56 × 16-in. tires in twin-tandem arrangements spaced 31¼ in. on centers laterally and 61¾ in. on centers longitudinally.

The effect of this change has been estimated by calculations, full-scale strain measurements and model study to be a 50 percent reduction in critical stress. However, there is still considerable question as to the advisability of depending upon critical stress control, when limiting strain-repetition of the subgrade at edges and corners may control. Full-scale traffic tests of these conditions are now under way at the Lockbourne Army Air Base, Ohio.

Acknowledgments

These studies were conducted with the authority of and by the direction of the Chief of Engineers, Corps of Engineers, Department of the Army. The information presented herein is approved by him, but the views and opinions expressed are those of the author and do not necessarily express the policy of the Department. The gathering of pertinent information is a Corps-wide study which has utilized the services of several hundred individuals.

Several of these men deserve particular mention: Messrs. Gayle McFadden and Thomas B. Pringle, Members ASCE, for over-all direction; Prof. Raymond E. Davis, M. ASCE, University of California, who directed the Hamilton Field studies; Mr. Fred A. Robeson, the Maxwell Field studies; Mr. K. F. Gunn, the McDill Field studies; Messrs. M. K. Johnson (deceased) and Robert F. Jackson, the Fort Knox studies; Mr. Edgar Alcott, the Northern Field studies. This work centered in the Ohio River Division Laboratories, designated as the Corps' Rigid Pavement Laboratory, where Messrs. F. M. Mellinger, Assoc. M. ASCE, E. P. Bone, and C. H. Christiansen acted in supervisory capacities. Dr. H. M. Westergaard, M. ASCE, Dr. P. C. Rutledge, Assoc. M. ASCE, Mr. O. J. Porter, M. ASCE, Mr. J. L. Land, M. ASCE, Dr. F. C. Lang (deceased) and Dr. Francis Baron acted as consultants.

Court Denies Recovery of Increased Dredging Costs Caused by Hurricane

Decides Against Contractor in Case Based on Changed Conditions

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ACCORDING TO THE majority decision of the Court of Claims, changes in the amount and character of dredging caused by a hurricane do not entitle a contractor to additional compensation. An interesting litigation between a dredging contractor and the Government, the ruling of the court based on its interpretation of the specifications of contract, and a dissenting opinion filed by one of the three judges on the case are presented in the following account. The case is that of the Arundel Corp. versus the United States, reported in 103 C. Cls. 688. The article also quotes from other decisions of the Court of Claims in regard to responsibility for subsurface conditions not disclosed by the information furnished bidders, and cites an example of protection for contractors in such cases.

SPECIFICATIONS for dredging a section of the Cape Cod Canal stated that the site was not exposed to storm action, gave the maximum current velocities and tidal ranges, and further stated that, "Failure to acquaint himself with all available information concerning these conditions will not relieve the contractor of responsibility for estimating the difficulties and costs of successfully performing and completing the work as required." After describing the materials found in dredging an adjacent area, the specifications set forth that the Government "does not guarantee that other materials will not be found nor that the proportions of the several materials will not vary from those indicated by the explorations."

Application of Article 4

The specifications further stated that "if materials, structures or obstacles of a substantially different character are encountered in the execution of the prescribed work and the cost of their removal or satisfactory treatment obviously would be, in the opinion of the contracting officer, either in excess of or less than the contract price, the contracting officer, in either alternative, will then proceed in accordance with the provisions of Article 4 of the contract."

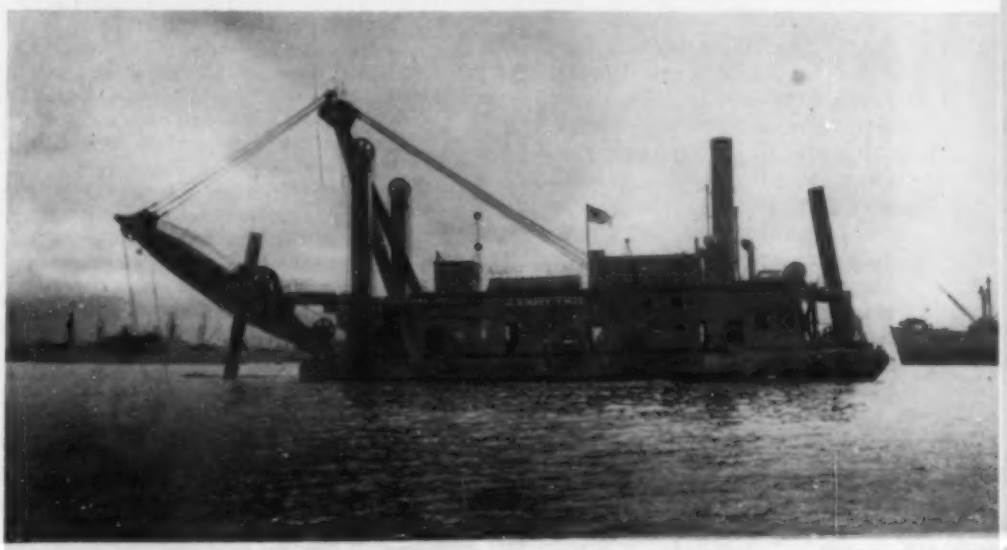
Article 4 of the contract (Standard Government Contract Form) reads:

"*Changed Conditions.* Should the contractor encounter, or the Government discover, during the progress of the work subsurface and/or latent conditions at the site materially differing from those shown on the drawings or indicated in the specifications, or unknown conditions of an unusual nature differing materially from those ordinarily encountered and generally recognized as inhering in work of the character provided for in the plans and specifications, the attention of the contracting officer shall be called immediately to such conditions before they are disturbed. The contracting officer shall thereupon promptly investigate the conditions, and if he finds that they do so materially differ the contract shall, with the written approval of the head of the department or his duly authorized representative, be modified to provide for any increase or decrease of cost and/or difference in time resulting from such conditions."

Erosion Reduces Dredging Quantities

Experience with similar work in the vicinity had shown that, owing to rapid currents, material in the dredged cuts was eroded when disturbed by the process of dredging. For this reason the quantity of material to be removed was estimated to be 75 percent of the actual amount in place.

Bids were opened on August 24, 1938. After some negotiations a unit price was agreed upon on September 10, 1938, and the contract was executed on October 6. Meanwhile, on September 21, 1938, a destructive hurricane swept the New England coast. During this hurricane the velocity of the wind was so great as to cause a current of from 10 to 12 miles an hour in the canal, removing a considerable amount of material from the area covered by this contract. Principally, if not entirely, from this cause the contract was re-



CONTRACT DISCUSSED in text stipulates calling attention of contracting officer to conditions at site differing from those indicated in specifications. U.S. Navy steam dipper dredge *Hellgate* pictured here has steel hull, 140×48×15 ft deep; and draft of 12 ft forward and 9 ft aft. Steam-driven dredge has 8-cu yd dipper and can dredge to depth of 50 ft with maximum capacity of 7,500 cu yd in 24 hours.

COURT DECIDES CONTRACTOR is not entitled to extra compensation for loss of material eroded by swift current resulting from high-velocity wind in area covered by contract. In view above, clamshell dredge *C. F. Weeber* owned by Hawaiian Dredging Co. is shown clearing shipping channel in waters near Hawaii. Dredge has hull 110×45×9.2 ft deep and displaces 458 gross tons. Its power plant is diesel-electric, rated at 240 hp, and its clamshell bucket has capacity of 4 cu yd.

duced by 425,950 cu yd from the original estimated amount of 2,894,500 cu yd. The fact that there had been a material reduction in the amount of excavation was not known when the contract was executed but was discovered prior to the commencement of dredging operations. The contractor at once requested either an increase in the unit price or the addition to the contract of a compensating amount of work.

This request was denied and the contractor entered suit, claiming that the material removed by the hurricane was the more easily dredgeable material with a high bank, that the average haul to the dumping ground was increased and that the reduction in quantity increased the unit cost of fixed items such as moving plant to and from the job. Further it was claimed that an increase in price was justified because of a "changed condition" under Article 4 of the contract, as quoted above.

Majority Opinion of Court

The Court of Claims stated in its (majority) opinion: "It will be seen from the specification provisions referred to that defendant only gave plaintiff the information which it had obtained in June, 1938, and made no warranty or binding representation that plaintiff would not encounter conditions different from those indicated. . . . it only bound itself to make an equitable adjustment if materials, structures or obstacles of a substantially different *character* from those described . . . were encountered, and that did not occur."

"The subsurface or latent conditions materially differing from those shown or indicated in the contract, referred to and contemplated in the first part of art. 4, were subsurface or hidden conditions which actually existed but were unknown by either party at the time the specifications and drawings were prepared and at the time the bid was submitted and accepted, and because of which unknown conditions the representation or indication in the plans and specifications would have to be substantially varied or changed in order for the defendant to obtain the completed work as called for and intended by the contract."

"We think the Government did not, by art. 4, assume an obligation to compensate plaintiff through an increase in the contract unit price for any increase in its anticipated dredging costs per cubic yard, or reduction of its anticipated profit not caused by any act or fault of the Government, but brought about and caused by a hurricane which neither party expected or could anticipate. . . . The plaintiff assumed the risk of the amount of material to be dredged being reduced, as it was, by the hurricane, an act of God, just as the Government would have had to assume the risk of having to pay for an increase in the material necessary to be dredged for the same reason as was the case in Tacoma Dredging Co. v. United States, 52 C. Cls. 447, where a flood caused an increase of 67,000 cu yd. It is a general principle of law that neither party to a contract is responsible to the other for damages through a loss occasioned as a result of an act of God, unless such an obligation is expressly assumed. . ."

ARTICLES ON the preparation of specifications and the protection of legal rights for the guidance of both owner and contractor in avoiding risks of litigation have been presented in recent issues of CIVIL ENGINEERING. In the April and May 1947 issues, Oren C. Herwitz, counsellor at law, New York, N.Y., explained how parties to a contract make their own law and described the legal problems involved in extra-work claims, the specifications of means and methods of construction, and the protection of the legal rights of the parties to a contract litigation. The importance of writing clear, precise specifications and contracts is emphasized by George B. Hills, M. ASCE, and Charles F. Lovan in the November 1947 issue.

Dissenting Opinion Filed

The majority of the Court therefore found the plaintiff not entitled to recover, this opinion being held by two judges. A third judge disagreed and filed a dissenting opinion, stating in part: "The purpose of the article (Article 4) "is to induce bidders not to increase their bids because of fear of unknown impediments to profitable performance. For the sake of obtaining a lower bid the Government is willing to forego the security of an unconditional promise of the contractor to accomplish specified results for a fixed or computable price regardless of impediments. If the article is to accomplish its purpose, it must mean, in a case like this, that the physical facts which the Government describes in its invitation for bids and which the bidder assumes in computing his bid may be taken as given, so far as they are material to the computation. If, as here, the bid is a unit price bid, the approximate number of units, with regard to the ease or difficulty of their handling, are the things most essential to know in computing a bid.

"If the bidder figures closely, as Article 4 is intended to induce him to do, but finds upon performance that the number of pay units is some hundreds of thousands less than both parties supposed, and that the missing units are those which would have been easiest and most profitable to handle, he in fact losses money though he has

prudently. If the Government knowingly or negligently misled into the same financial plight which he finds himself it would be liable to him in damages. I think that, in general, Article 4 means that the Government promises him equitable treatment when he finds himself in that situation though it was not at fault in getting him there.

"Here the Government survey had shown that approximately 2,894,500 cyd of pay dredging would be available in the plaintiff's section. In estimating that figure it had discounted the gross amount in place by 25 percent because of expected erosion due to the normal currents flowing through the cuts while the dredging was going on. The Government and the plaintiff assumed that the materials to be dredged would have the normal quality of canal bottom materials with which both were familiar from past experience. The plaintiff made his bid. Then came the hurricane and scoured out some hundreds of thousands of pay units of the materials, most of the units being of a quality most profitable to handle, and being removed from a location where they could have been hauled away by the shortest haul. The Government and the plaintiff, still in ignorance of the changed condition, made their contract. As I have indicated, I think that when the true condition was discovered, an equitable adjustment was due under the contract."

What Are "Changed Conditions"?

As stated by the dissenting judge in the Arundel case, the original purpose of the article entitled "Changed Conditions" must have been to induce bidders not to increase their bids because of fear of unknown impediments. Or, as has been said by the Court in another case (96 C. Cls. 148), "If this situation was not within the interpretation of Article 4 the alternative is that bidders must, in order to be safe, set their estimates on the basis of the worst possible conditions that might be encountered. Such a practice would be very costly to the defendant. We suppose that the whole purpose of inserting Article 4 was to induce bidders not to do that."

However in many cases the purpose of this article has been weakened if not entirely destroyed by "escape clauses" in specifications, such as, "Bidders must visit the site and inform themselves as to the conditions and difficulties of the work and no allowance will be made for failure correctly to estimate the difficulties." (84 C. Cls. 84.)

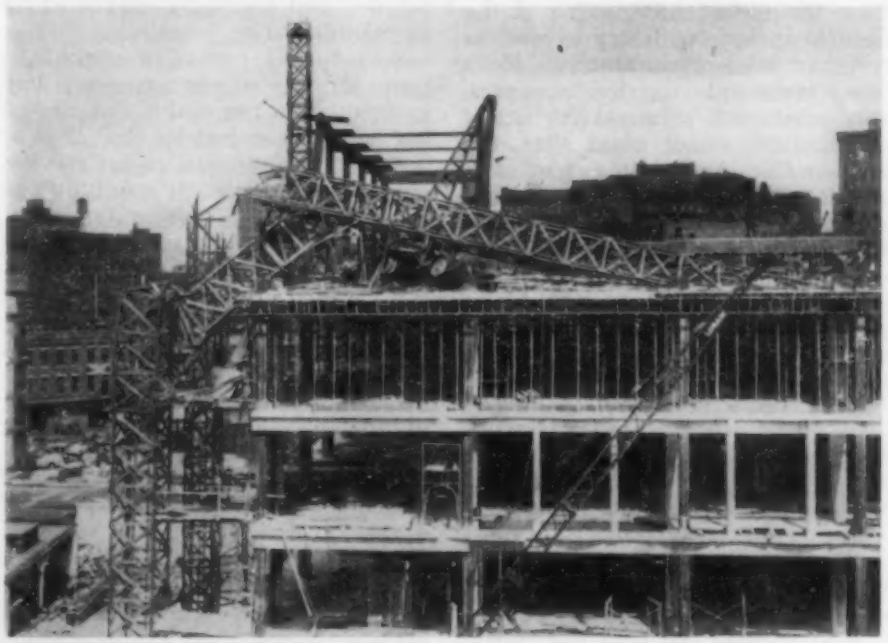
Numerous cases involving claims under "Article 4" have come before the Court of Claims. The decisions of that court, in general, have been based on the doctrine that contractors cannot recover in the absence of fraud or positive misrepresentation on the part of the Government. In the case of the Trimount Dredging Co. (80 C. Cls. 559), the specifications stated, "The material is believed to be soft mud and soft clay with some broken pile ends in the site of the old railroad bridge, but bidders are expected to examine the work and decide for themselves as to its character and make their bids accordingly." The contractor found and removed 752 piles, of which 295 were outside the old bridge area, and also concrete blocks, railroad iron and timbers. The Court dismissed the contractor's claim, stating that the Government, in the absence of fraud or misrepresentation on its part, is not liable for the cost of removing piles and other obstructions not specifically mentioned in the specifications.

In the claim of Triest and Earle (84 C. Cls. 84), the contractor encountered heavy timbers which had been left by another contractor. The Court, in denying compensation, said "It was a case of misfortune on the part of the plaintiff and not a case of misrepresentation on the part of the Government. When the bids were called for and the contract entered into there was no knowledge by the Government of any impediments." Also in the case of the Grier-Lawrence Construction Co. (98 C. Cls. 434), the decision stated, "Absence of disclosure by the Government of subsurface conditions unknown to the contractor is not a ground for recovery . . . where the Government not only did not know, but had no duty to know, such conditions; and where the plaintiff by the exercise of prudence could have known such conditions, having by the terms of the contract assumed the risk of such variations in the condition of the work as actually were encountered."

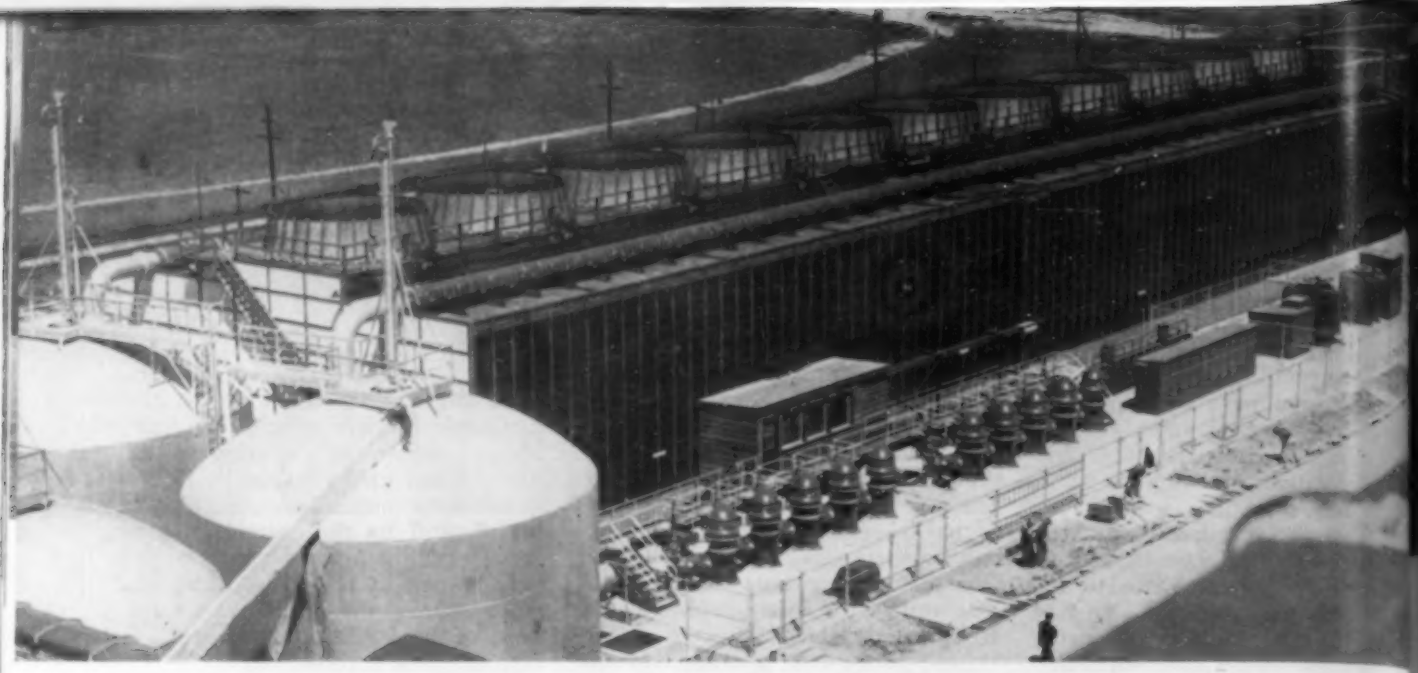
On the other side of the picture, but decided according to the same rule, is the case of John K. Huff (96 C. Cls. 148), where bidders were informed that test pits and other excavations showed no rock and that the nearest rock outcrop was two blocks from the site. The contractor assumed from this that there would be no rock excavation and when this proved to be erroneous he claimed extra compensation. The specification stated that bidders should examine the site and inform themselves

(*Continued on page 84*)

Brisk Atlanta Gale Topples Wooden Hoist Towers



TOPPLED BY 65-MPH GALE, upper sections of two wooden hoist towers come to rest on partially completed building in Atlanta, Ga. Fall of first tower smashed tower bracing and loosened guy wires of second, causing its collapse. Contractor's truck on fifth-floor level is damaged by one of falling towers. Third tower is undamaged. Designing, anchoring and bracing towers to withstand higher wind loads in gale areas can do much to avert construction delays of this nature. (Photograph courtesy of Associated Factory Mutual Fire Insurance Companies.)



MANY INDUSTRIES need services of sanitary engineers to handle water requirements, remove industrial wastes and guard against health hazards. Cooling tower (above) handles 33,000 gpm at plant of American Viscose Corp., Front Royal, Va., in processing water for waste acid reclamation department.

Industry Increases Demand for Sanitary Engineers

EDMOND T. ROETMAN,
Assoc. M. ASCE

Sanitary Engineer, American Viscose Corp., Philadelphia, Pa.

EXPANDING OPPORTUNITIES for sanitary engineers have resulted from the recent broadening of the field to include industry as well as governmental organizations. More firms are employing full-time sanitary engineers to supervise utility distribution, select plant sites, design water and waste treatment plants and supervise sanitation programs. Some of the new outlets for members of this profession are outlined in the following article.

NEW OPENINGS are becoming available in industry for sanitary engineers. In the past the limited outlet for their services was largely confined to governmental organizations such as city, state and federal health departments or to consulting engineering firms working on projects for those organizations. A few also have been employed by privately owned water companies.

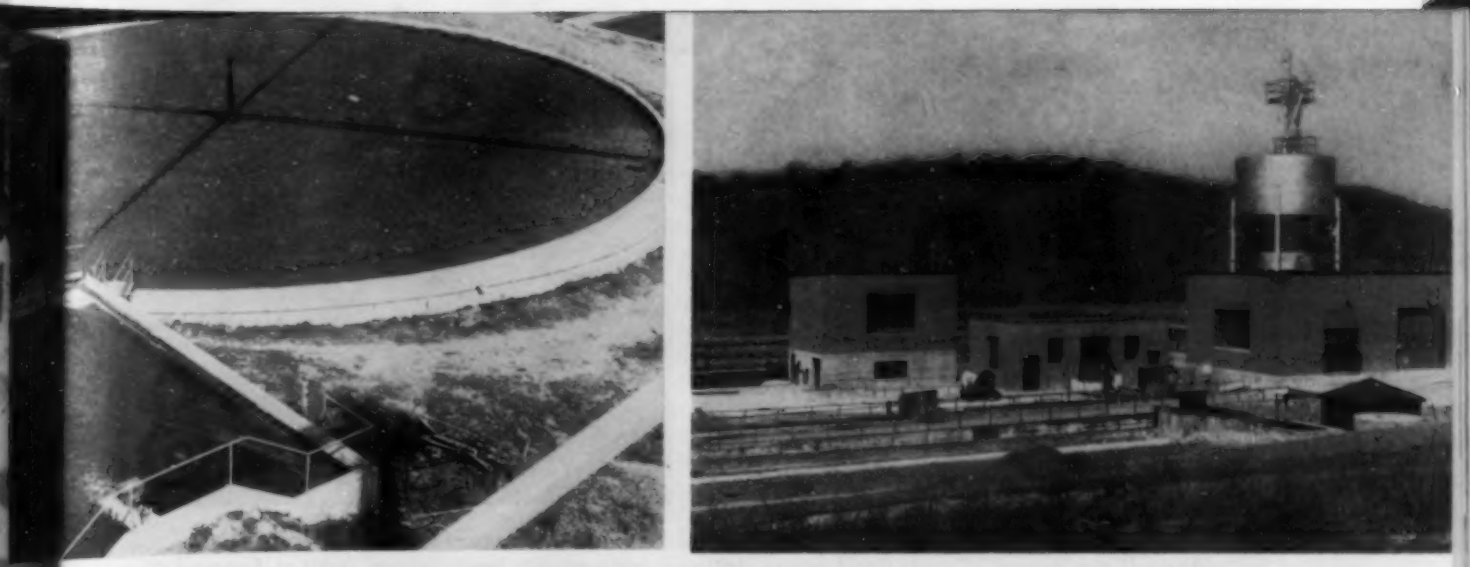
But recently the field has broadened. A few industries have employed full-time sanitary engineers and the trend is for more to follow suit. Industries that can use the services of sanitary engineers to advantage are steel, automotives, textiles, fermentation, railroads, petroleum, chemical and drugs, pulp and paper, food processing, dairies, and tanning.

The capacity of an industry to employ a sanitary engineer is not so dependent upon size of organization as upon other factors such as water requirements, industrial wastes to be handled and health hazards incident to manufacturing processes. Many small industries cannot afford the full-time services of an engineer, but groups within reasonable distance of one another can join for this purpose or their trade associations can employ one or more to act as consultants for their members. This is especially true in the food processing, dairy and tanning industries.

Sanitary Engineers Plan Utilities

A sanitary engineer will find plenty to keep him busy in supervising the utility distribution for his firm. Some industries have as many as eight different types of water that must be distributed through separate systems of mains to points of use. The types of water most frequently encountered are fire, plant process, cooling, drinking, soft and distilled water. In addition some industries have both hot and cold systems for process water and soft water. The design and maintenance of such a multitude of water distribution systems is a big job if properly handled and if not properly handled can become a continuous source of trouble and expense.

Sewers constitute another item that calls for intelligent application of sanitary engineering skill. Here we may find one sewer system handling all the wastes or several separate systems handling different wastes. It is rapidly becoming necessary to consider treatment for industrial wastes and many of these are of such a nature that they must be handled separately. At many old-established plants all wastes are discharged into a common sewer, and when waste treatment plants are constructed the work of resewering the plant to separate the wastes for treatment may cost as much as the treatment plant, sometimes running into hundreds of thousands of dollars. Proper design of the sewer system at the start and intelligent supervision of all future additions can do much to save expensive reconstruction at a later date. In plants of any considerable size, at least three sewer systems are generally needed—one for sanitary sewage, one for industrial wastes that require treatment and one for clean water such as rain and cooling water that does not need treatment. In addition it is often advantageous to separate the acid and alkaline wastes to secure more economical treatment. Occasionally there are special wastes that must be kept separated because they require special treatment or pre-treatment before mixing with the other wastes. In some plants mixing of the various wastes in the sewers is undesirable because of the formation



SEPARATE SYSTEMS handling different wastes are essential in many industries. Expensive reconstruction can be avoided by proper design of original system and intelligent supervision of additions. Trickling-filter system (above, left) treats sulfide waste at American Viscose Corp., Front Royal, Va. Treatment plant (above, right) is for acid waste.

dangerous or noxious gases that seep out of the various sewers into the manufacturing plant. Six separate sewer systems are not uncommon in some industries, especially those of a chemical nature.

The continuous improvements and changes in processes in some industries require almost constant changes in utility services and sewer systems. This work often reaches a magnitude requiring the full-time services of an engineer and several draftsmen.

Aids Selection of Plant Sites

The sanitary engineer can render valuable service to industry when new plant sites are being chosen. He is qualified to examine and pass on the water supply available, which in many cases is the deciding factor in selecting the site. His examination will cover possible surface and groundwater supplies, with special attention to temperature, quality and quantity. In addition, a pollution survey is now considered necessary to determine the present and possible future pollution of the water supply and the capacity of the stream to absorb wastes to be discharged from the proposed plant.

The engineer employed by and familiar with a particular industry can save it considerable capital investment and operating cost by designing a water treatment plant to serve its particular needs. The design of an industrial water treatment plant becomes complicated at times, since the plant may be required to furnish potable water, soft water, distilled or deionized water as well as process water.

Only occasionally, and usually only in large industries, is an engineer called on to assist in selecting a plant site or to design a water treatment plant, but the operation of the water treatment plant furnishes a continuous job. The operation of an industrial water plant calls for close supervision and control to produce the desired quality of water at the lowest cost. The problems encountered are similar to those in the potable water field except that less attention may be paid to bacterial quality and more to chemical characteristics. The very low tolerances of chemicals such as iron, manganese and silica which must be adhered to add materially to the difficulties of treatment. This problem calls for the special knowledge and training of the sanitary engineer. Since many industries have several water treatment plants with capacities of several million gallons a day, the employment of a sanitary engineer to supervise them is easily justified.

As director of industrial waste treatment, the sanitary engineer becomes a valuable member of the staff. He is capable of studying the problem and developing a treatment procedure that fits the particular industry and plant involved. Often the major portion of industrial pollution abatement is obtained by changes in plant processes to eliminate wastes rather than to treat them, and an engineer working for the industry is in a position to take full advantage of possible process changes. Where treatment is needed, the sanitary engineer can design a plant that will meet requirements with the lowest capital investment and operating costs.

The operation of industrial waste treatment plants is generally a large item in an industry's budget, and proper supervision and control can often mean the difference between profit and loss for the year. In many industries the waste treatment problem is continuously changing as processes and materials used in manufacturing change. A qualified engineer can anticipate these changes and adapt the treatment plant to handle them as they occur, thus preventing many unpleasant situations that would otherwise arise.

One of the most valuable assets a sanitary engineer has from the viewpoint of industry is his ability to discuss stream pollution problems with various governmental officials on common grounds. Those industries that have a sanitary engineer usually find their industry-state relationships much more pleasant because of the engineer s acquaintance with the various officials and the mutual respect and understanding that develop.

DESIGN OF ADEQUATE SANITARY sewage treatment facilities for industrial plant is responsibility of sanitary engineer in protecting health of employees. Other duties include supervision of general plant sanitation and industrial hygiene programs.

WATER SUPPLY MAY BE DECIDING FACTOR in selecting plant site for industry. Sanitary engineer studies surface and groundwater supplies and makes pollution survey. Gravity filters (above, left) and sedimentation basins (above, right) of American Viscose Corp. water plant handle 12 million gal of water per day. Employment of sanitary engineer to supervise such plants is easily justified.

If the sanitary engineer employed by industry should find time on his hands after taking care of utilities, water supply and waste treatment, he can supervise general plant sanitation and industrial hygiene programs that will protect and improve the health of employees. As a rule the cost of maintaining clean sanitary facilities and of controlling health hazards caused by gases, fumes and dusts is more than made up by reduced compensation insurance and increased employee morale.

This article has briefly covered the various ways in which a sanitary engineer can serve industry in an effort to show that he will be an important addition to the supervisory staff. However, to be of maximum value he should have a position high enough in the organization to insure him enough authority to carry out his work properly.

State and Local Public Works Programs Need Advance Planning

PHILIP B. FLEMING
Major General, U.S.A.

Administrator, Federal Works Agency

From a recent report by General Fleming to the President of the United States on the status of public works needs and plans.

IT IS common knowledge that this country has a huge accumulation of construction requirements for new state and local public works. We need highways, schools, hospitals, airports, water systems, sewer systems and many other facilities. We need them to maintain and promote the welfare and safety of the people in our communities, as well as to support commerce and industry.

This deficit has been growing since 1930. It mounted sharply during the war. And even after V-J Day public works yielded priority to the imperative demand for housing and other types of private construction.

There is no exact measure of today's needs for public works, but preliminary surveys and estimates completed and in process indicate that the dollar volume of necessary state and local construction for the next few years approximates $75 billion. But even this figure spread over a 15-year period would call for an annual construction volume of $5 billion—nearly $2^1/_2$ times the 1947 rate of state-local construction.

Some recognition of this need is reflected in proposals for specific state and local construction projects. At the end of June 1947, this backlog stood at $19.9 billion. These figures, gathered by a leading engineering publication, are not complete and they include projects at every level of planning and design up to the point of actual construction.

This awareness is encouraging—until we look a step further and compare these very substantial figures with the volume of plans that are really completed, blueprinted and ready for the contractor.

Here the gap between promise and performance—between recognized needs and completed plans—is dangerously wide. As of June 30, 1947, the value of all completed state-local plans (both with and without federal assistance) totaled only $2.4 billion. This was only $200 million more than the comparable total on December 31, 1946. And all the gain occurred in planning carried out with federal advances—the dollar volume of plans completed without federal help showed a net loss from the comparable total of six months earlier.

Every public works official knows well that it may take from six months to two years to bring proposals to the point where construction can begin. To move from thinking about a project to actual building we must cross a complex maze of engineering, financial and legal work, arrange for land acquisition and design the structure. The last depression taught us that without adequate planning it took many months to put even a handful of unemployed to work on useful public projects.

Quite apart from the possible need for public works to stabilize the construction cycle and help bolster the business cycle, we need more advance planning merely to assure an orderly flow of public construction in prosperous times like the present. Today the effective shelf of plans is equivalent to little more than one year's work at the 1947 inception rate; contracts let by state and local governments during the first nine months of 1947 amount to $1.6 billion.

If public works expand because of the pressure of needs—our shelf may well become depleted. If a downswing in the business cycle should

ll for a broad expansion of public nstruction, we simply would not ve the necessary volume of public orks planned in advance.

But there is a way to bridge this p and Congress indicated it clearly hen it authorized the Advance lanning Program under Title V the War Mobilization and Recon- ersion Act of 1944. The funds pro- ded by that program stimulated the esign of projects all over the country. was justly hailed as the most pro- ressive step we have ever taken to- ard orderly planning of public works.

Under this wise and effective pro- ram the Federal Works Agency made epayable advances to state and local overnments for the cost of profes- sional services in preparing drawings and specifications. Advances were made totaling about $61 millions. As a result, plans for over 7,200 useful public works projects are emerging, representing a total cost of some $2^1/_3$ billion dollars of non-federal funds.

This was the finest kind of insurance against waste and haste. But unfortunately the authority to make these advances lapsed with the expiration of Title V on June 30, 1947. This left many local needs unsatisfied and took away the healthy impetus to enlarge the country's reserve of effective plans for public works.

Bills which would restore this opportunity are pending in Congress. Indeed it may well be that many members of both houses are not aware that the advance planning program terminated on June 30. Members may not have realized that the door was swinging shut on many community plans and programs.

In any event, the far-reaching needs of our communities are clearly established. Fundamentally they are human needs, but they have their counterpart in many unsolved problems of business and industry. Only a sound, forward-looking public construction policy can help us meet these needs in the order of their urgency. The keystone for such a sound policy is advance planning which federal repayable loans can stimulate and assure.

Cantilever Steel Forms Expedite Work on Bull Shoals Dam

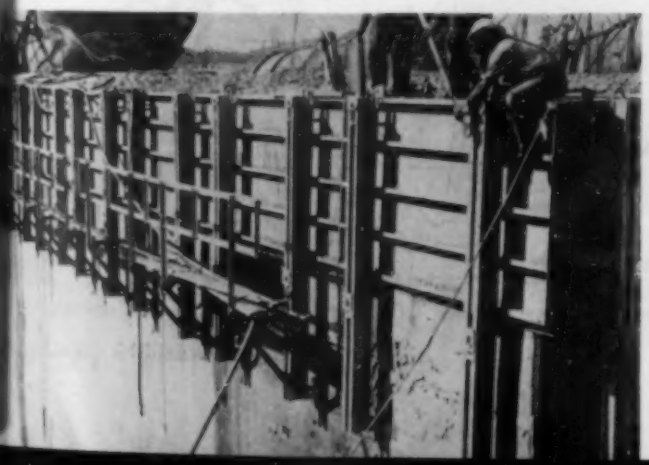
TIME- AND EFFORT-consuming operations of build- ng large forms, keeping them true and moving them as eavy concreting work progresses, are alleviated by a new ight steel cantilever-type concrete form that eliminates onventional tiebacks and about 60 to 75 percent of the nchors normally used.

The new cantilever form developed recently by the Blaw-Knox Co. of New York and used in the construc- ion of Wolf Creek Dam in Kentucky, Fall River Dam n Kansas, and East Sydney Dam in New York is based n a new principle which involves anchoring of the form o the block of concrete previously poured.

A $22,146,000 contract has been awarded to the Blaw-Knox Co. by Ozark Dam Constructors—a group f nine contractors—for use of the new forms in pouring ome 2,500,000 cu yd of concrete in constructing Bull Shoals Dam, part of a flood control and hydroelectric ower project on the White River in Arkansas, under the irection of the Corps of Engineers. Nearly 2,000,000 q ft of surface will be serviced by the new steel forms in his project. The dam will be 2,256 ft long and will have height of 280 ft from bedrock to the roadway that will traverse it. Total cost of the dam is estimated to be around 47 million dollars. The contractor's bid was $22,146,000 exclusive of aggregates and materials to be furnished by the government.

CANTILEVER STEEL FORM, used for first time in pouring concrete of Wolf Creek Dam, Kentucky, is anchored into block of concrete previously poured. Ease of handling and elimination of tie-rods and 70 percent of anchor bolts saves time, labor and materials. Inclined downstream cantilever panels are equipped with bracket outriggers at top forms to facilitate handling of panels. Adjustable curved forms for downstream ogee surface are designed to permit varying curvature.

ANCHORS FOR SUCCESSIVE LIFTS are set by template bolts hrough top of form. As each list is completed, lower template olts are removed and form is raised 5 ft to next pouring level here it is again clamped in position to two $1^1/_8$-in. screw anchors mbedded near top of newly completed section. Pictured here re cantilever forms used in constructing upstream face of Wolf Creek Dam in Kentucky. Light steel outside work platforms are upported by angle brackets from uprights.



PHILADELPHIA TERMINAL DESIGN (above) includes modern features such as newsreel theater, rest rooms, hotel rooms, garage and covered parking area. Passengers are not exposed to weather while loading and unloading. Philadelphia won Haire Airport Trophies Award in International Airport category for design plans prepared by Airways Engineering Consultants, Inc. Carroll, Grisdale and Van Alen were retained as architects.

Philadelphia Conducts Extensive Subsurface Exploration Prior to Airport Expansion

ELGIN W. SCOTT, Jr.
Lt. Col., Air Res.
Airways Engineering Consultants, Inc., Washington, D.C.

ALREADY EQUIPPED to handle more than 85 flights daily of five major airline companies and private planes, Philadelphia Southwest Airport is undergoing a face-lifting and expansion program which will greatly enhance its service facilities. The program, now under way, calls for grading and draining 175 acres which comprise the new terminal area. This area is in addition to the present 494-acre airport and a part of the ultimate 2,400 acres proposed for airport use. The building phase of the first construction stage calls for a new 22-gate international terminal building with loading apron, additional hangars and extension of two runways. Three more airlines are expected to make use of the expanded facilities. To eliminate non-uniform settlement and eventual pavement failures the City of Philadelphia and its consultants, Airways Engineering Consultants, Inc., of Washington, D.C., conducted extensive soils tests and analyses in both present and expansion site areas. The tests showed the need for extreme care in placing all fills to avoid the creation of mud waves. The first stage of construction of the $40,000,000 airport is now well under way. When completed, it will be capable of handling approximately twice the present operations of the Washington National Airport.

IN THE CONSTRUCTION of concentrated-load masses such as buildings, bridge piers and docks, undesirable subsurface and foundation conditions may be overcome by driving piles or excavating to rock, but these solutions are not feasible in the landing, taxiing and parking areas of airports because of the extensive areas covered. Providing fill of suitable characteristics and sufficient thickness, placed in such a manner as not to create unstable conditions beneath it by its own weight, is the most logical and economical means of creating stability over such large areas when the existing soil has insufficient bearing capacity. Where necessary, undesirable soil must be removed and such areas backfilled. To determine these factors, extensive subsurface exploration must be undertaken and a careful analysis of results made by competent soils engineers.

Other major air terminals, such as LaGuardia Airport in New York, have developed unequal settlements to the point of requiring costly repairs. Determined to eliminate such future difficulties, the city of Philadelphia and its consultants,

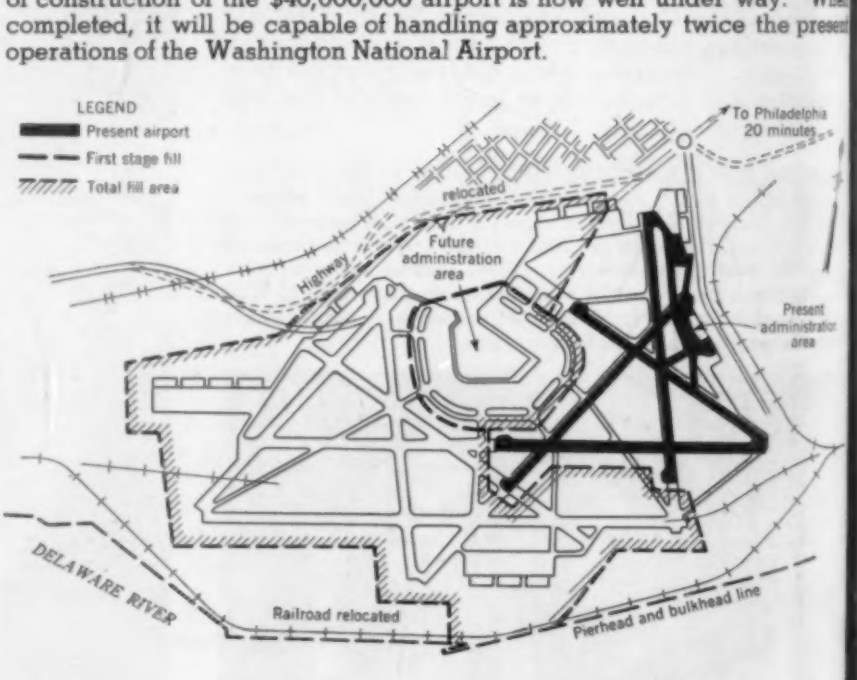


FIG. 1. AIRPORT LAYOUT shows present area and its proposed expansion. Limits of first-stage (terminal-area) fill and limits of ultimate fill area are indicated.

FIRST CONSTRUCTION PHASE consists of clearing, filling and draining new terminal area. Euclid truck and loader are part of 85 pieces of equipment used on airport project. Goodyear photo.

irways Engineering Consultants, c., Washington, D. C., delayed nstruction until soils investigaons and analyses were completed.

The Southwest Airport is located djacent to the Delaware River near s confluence with the Schuylkill iver (see Fig. 1) and most of the ea is now below mean high tide in e river. The soil structure is for e most part silt or silty clay with ery high water content and low bearg and shear strength. At the time e airport consultants were retained y the city, Elwyn E. Seelye and Co. ere making borings and plate bearg tests in the present airport area. heir tests indicated that below the isting fill, principally ashes, a tratum of gravel and sand underlay layer of clay or silty clay of varying hickness. John B. Rulon and Co., etained by Airways Engineering Conultants, made subsequent tests at ot locations in the adjacent exansion area, confirming the previous onclusions. These preliminary borgs also served as a guide to the pacing and depth of additional orings necessary before the preparaion of detailed plans and specificaons for the fill.

Test Holes Drilled at 250-Ft Intervals

According to predetermined plans or stage development of the airport, he first construction phase consists f clearing, filling and draining the ew terminal area. Raymond Conrete Pile Co. was retained to make further exploration of subsurface onditions in this particular area by rilling test holes at each intersection f grid lines laid out 250 ft apart in oth directions (see Fig. 2). This ork, using three drill rigs, was started around November 1, 1946, and was finished within seven weeks.

After completion of approximately 15 holes, the logs of the borings and the samples taken from the holes were studied by the engineers and their consultants, Dr. Arthur Casagrande, M. ASCE, and Thomas A. Middlebrooks, Assoc. M. ASCE. Because of the reasonable uniformity of underlying material, it was decided to increase the boring spacing from 250 ft on centers to 500 ft except in spots where buildings were to be located.

Sixty test holes were drilled to depths ranging from 16 to 90 ft, or an average depth of 37.75 ft per hole. Samples were taken from each stratum and more often when necessary to give a full and complete picture of underlying soil conditions. A total of 350 samples were taken, an average of 5.8 samples per boring or an average spacing between samples of 6.5 ft. A graphic representation of the location of borings, the depths of strata and the soil classifications was shown by the illustrated "peg model" (Fig. 3), covering the terminal area with its building sites, auto parking, plane-loading apron and peripheral taxiway.

In a laboratory established at the airport, tests were made to determine water content, plastic limit, liquid limit, plasticity index and mechanical properties of each sample. The results of these tests substantiated previous conclusions regarding the types of soil to be encountered, namely, silt, clay, peat, sand, gravel, cinders and various combinations of all these types. A high water content and low bearing strength prevailed in the surface stratum throughout the area.

The top stratum was generally found to consist of silt or silty clay varying in thickness up to 30 ft. Under it a stratum of sand and

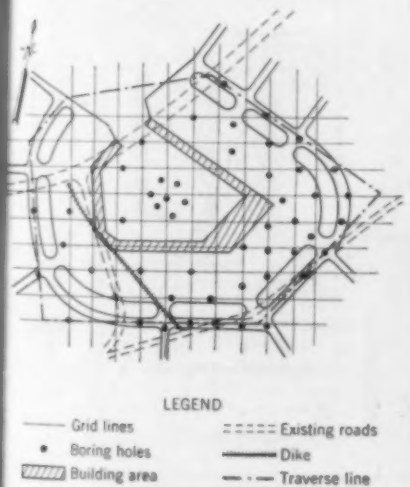


FIG. 2. GRID LINES 250 ft apart serve as guide for exploring subsurface conditions. Because of uniformity of underlying material, boring interval was changed to 500 ft.

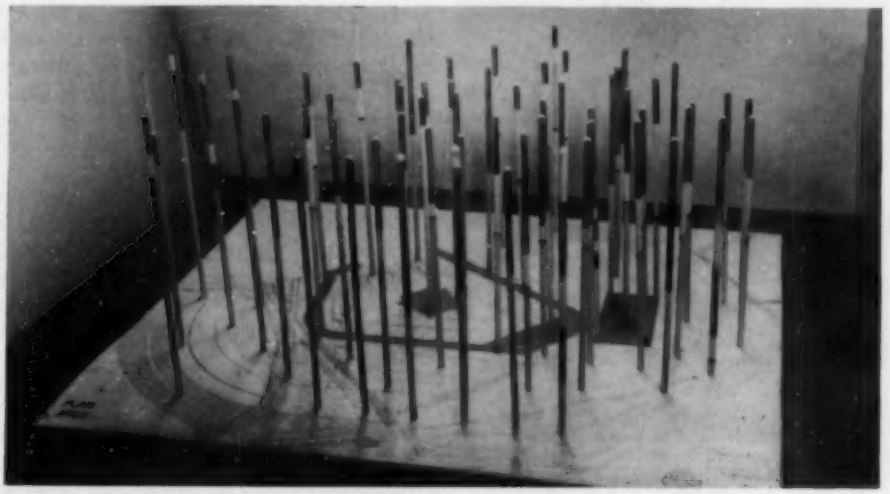


FIG. 3. PEG MODEL shows subsurface conditions in terminal area. With base of model representing El.–60, strata are plotted on vertical scale of 1 in. equals 5 ft. Black and gray shades represent undesirable silts and clays; light shades are sand and gravel. Dark rectangle at right shows location of test fill.

SIMPLE RIG provides means for making test borings in exploration of subsurface conditions in 150-acre expansion area of Philadelphia Southwest Municipal Airport. Preliminary borings serve as guide for spacing and depth of additional borings for detailed plans and specifications for fill. Photo courtesy Raymond Concrete Pile Co., N.Y.

PERIPHERAL DITCH with side slopes of 10:1 is excavated by dragline. Corrugated metal pipe drain is seen at far end of ditch.

gravel varying from 10 to 25 ft in thickness and another generally thin stratum of silt or clay were encountered before entering a stable sand and gravel condition (see Fig. 4). Because of the low shear and highly compressive characteristics of this soil, extreme care had to be taken in placing the fill to avoid concentrated loads. Otherwise there was a possibility of creating "mud waves" (horizontal movements of unstable subsurface soils from beneath the load-creating disturbance and subsequent displacement of surface soils at points of least resistance to such movement).

As called for in the specifications, the existing surface crust and root structure were not disturbed more than necessary. The top soil was not stripped nor were roots grubbed unless they were within 12 in. of the proposed subgrade.

Overload Fill Superimposed

The load imposed by the required fill in the terminal area (average depth of 6 ft amounting to approximately 1½ million cu yd) would in time consolidate the lower strata by forcing out the moisture, but during this period the surface of the fill would be unstable because of non-uniform consolidation resulting from the varying stratum depths and thicknesses. Furthermore it was estimated that a five-year period of settlement and consolidation would be required. To accelerate the consolidation period and to encourage uniformity of settlement, 5 ft of overload fill (approximately 680,000 cu yd) was superimposed on the required basic fill.

"As to the settlements due to the compression of the soft foundation under the weight of the superimposed fill, it is estimated that most of these settlements will develop within a period of two years after the construction of the fill," Dr. Casagrande stated. "If investigations should indicate that locally the settlements will proceed at a much slower rate, it would be possible to accelerate settlement by temporarily overloading such areas with additional fill which is allowed to remain in place until just prior to the construction of the pavement."

For further study of the amount of settlement to be expected under the load and the rate of consolidation two undisturbed samples were taken at representative locations in Shelby tubes and delivered to Dr. Casagrande's laboratory for testing. The were approximately 30 ft deep and nearly continuous as practicable.

To further verify the laboratory conclusions, a test fill area (part of the terminal area fill) was fenced and staked for periodic observations by the engineer. In addition surface stakes, two metal pipes welded to plates were placed on the existing surface before making the test fill to determine what part of the total settlement would take place in the

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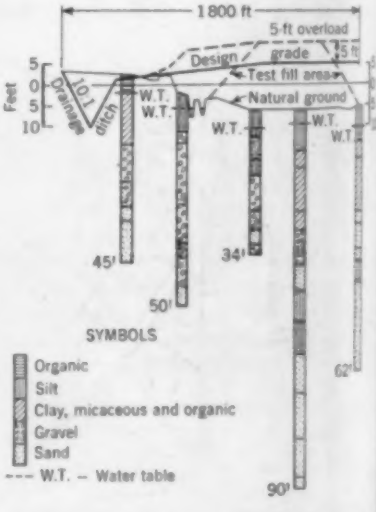


FIG. 4. TYPICAL CROSS SECTION showing present ground elevations, borings, design grade, overload section and test fill. Periodic observations of settlement of test fill are made to verify laboratory conclusions

EXTREME CARE is taken in placing fill to avoid creating "mud waves." Here, 1-in.-dia pipe is driven at test point in test fill. Observations of elevations of top of pipe are taken periodically to determine amount of settlement.

Engineers' Notebook

Graphic Comparison of "Specific Strengths"

THOMAS R. C. WILSON, M. ASCE
Consulting Engineer, Madison, Wis.

DETERMINATION IS often desirable as to which of several available materials will, when made into members of specified form and function, have the least weight for a required strength or stiffness; or will have maximum strength or stiffness at a given weight. For direct stress, compression or tension, such determination is made by dividing unit strength or modulus of elasticity by specific gravity or weight per unit of volume since the properties of the member depend only on the unit values and the cross-sectional area.

For strength and stiffness in flexure, or for strength as a long column, properties of the member are determined by higher powers of the dimensions, and division by a higher power of the specific gravity is required. In general, the quotient of the unit strength or the modulus of elasticity by the appropriate power of specific gravity may be termed the "criterion of merit."[1] Table I shows equations for the criterion of merit under various conditions.

A graphic method for comparing materials with respect to values of C was suggested by the writer and used in a recent release from the Forest Products Laboratory.[2] Figures 1 and 2 are reproduced from this release to illustrate the method. Values of S or E are plotted as ordinates against values of G as abscissas on log-log paper. Lines with slopes equal to the powers of G shown in Table I are drawn in the same diagram.

To find C for any material and condition, a line with slope appropriate to the condition is drawn from the point representing the material to the intersection with the vertical $G = 1.0$ and the ordinate of the intersection, as read from the vertical scale, is the value of C; or materials may be compared without determining C. For example, considering materials with grain parallel to span (upper part of Fig. 1), material S_1 is readily seen (by following the proper slopes and with-

[1] This term was used and equations for the criteria developed by S. Livingston Smith in "A Survey of Plastics from the Viewpoint of the Mechanical Engineer," Institution of Mechanical Engineers, *Proceedings*, Vol. 152 (1945), pp. 29–43.

[2] "Mechanical Properties of Laminated Wood," by E. C. O. Erickson, Mimeograph No. R1639, Forest Products Laboratory, Madison, Wis.

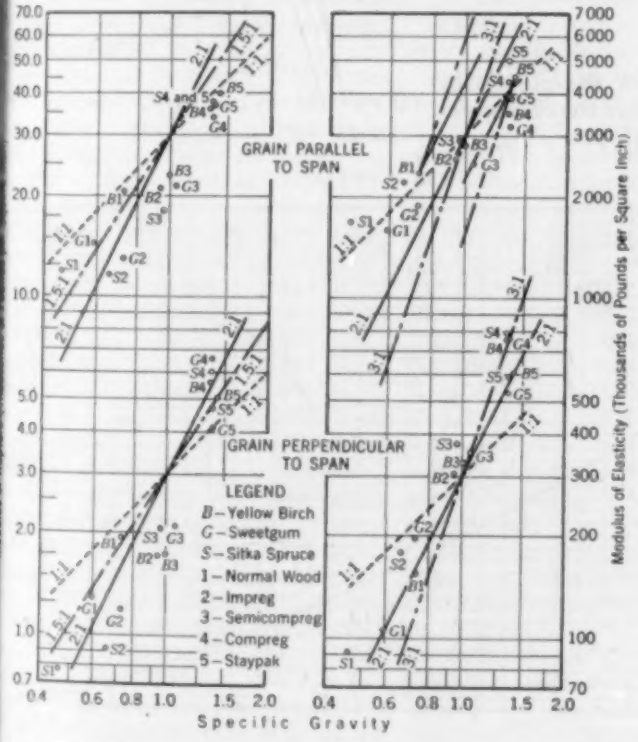


FIG. 1. RELATIONSHIP of flexural strength and stiffness to specific gravity of parallel-laminated modified wood.

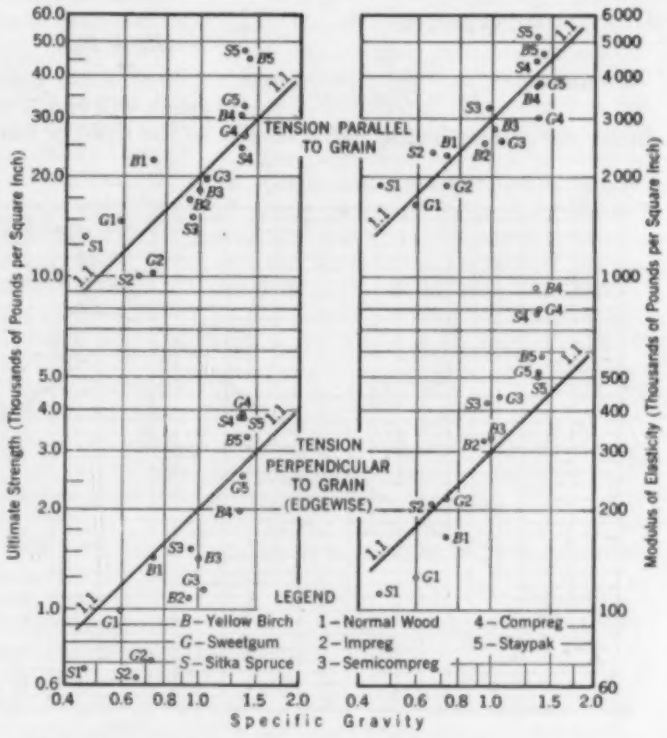


FIG. 2. RELATIONSHIP of certain tensile properties to specific gravity of parallel-laminated modified wood.

out drawing the lines) to have the highest value of C for both strength and stiffness under condition 2(b) (slope 2:1 for strength or 3:1 for stiffness) or 2(c) (slopes 1.5:1 for strength or 2:1 for stiffness), but is excelled for both strength and stiffness under condition 2(a) (slope 1:1 for either strength or stiffness) by several of the other materials.

Figure 2 affords similar comparisons for tension, and both figures demonstrate the great superiority of "parallel to grain" over "perpendicular to grain" in absolute values of the properties of the materials represented as well as in values of C.

TABLE I. VALUES OF C, THE CRITERION OF MERIT

Condition	Value of C for Strength	Value of C for Stiffness
1. Compression or tension.	$S \div G$	$E \div G$
2. Flexure*:		
a) Depth of member fixed and width varied†	$S \div G$	$E \div G$
b) Width of member constant and depth varied†	$S \div G^2$	$E \div G^2$
c) Depth and width of member both varied to give geometrically similar cross sections†	$S \div G^{2/3}$	$E \div G^2$

S = unit strength; E = modulus of elasticity; G = specific gravity.

* Since the strength of a long (Euler) column is determined by flexural stiffness, the value of C for stiffness for 2(a), (b), or (c) applies, depth in 2(b) or 2(c) being taken as the lesser cross-sectional dimension.

† Dimension or dimensions varied to afford minimum weight for the required strength or stiffness; or to afford maximum strength or stiffness for a given weight.

Graph Solves Cubic Equation When Cardan's Formula Fails

WILLIAM RUSSELL DAVIS, M. ASCE
Consulting Engineer, Edward P. Lupfer Corp., Buffalo, N.Y.

IN THE CUBIC, $x^3 + bx + c$, Cardan's formula gives the one only real root when b is positive and also when b is negative and numerically equal to or less than $\left(\frac{27c^2}{4}\right)^{1/3}$. For all other negative values of b, there are three real roots and Cardan's solution fails, for which case one of the three real roots may be readily obtained by use of the accompanying graph.

Compute $j = \dfrac{9c}{\sqrt{-(27c^2 + 4b^3)}}$ and obtain the corresponding value of P from the graph; then compute the root from $R_1 = -(P + 1)\frac{c}{b}$. The sign of this root is the same as the sign of c. A second real root is to be computed from $R_2 = \sqrt{\left(\frac{R_1}{2}\right)^2 + \frac{c}{R_1}} - \frac{R_1}{2}$ and the third root, $R_3 = -(R_1 + R_2)$.

Reasonable care in the use of the graph will give a value that is correct to the third or fourth place.

If a more precise value is desired, proceed as follows: Let R be the value obtained by use of the graph and R', R'', etc., be successive values of greater precision. Then

$$R' = \frac{2R^3 - c}{3R^2 + b}, \qquad R'' = \frac{2R'^3 - c}{3R'^2 + b}$$

etc.

Example: $x^3 - 11.52x + 9.61 = 0$. Then $j = 1.437$, $P = 0.0745$, $R = \dfrac{-(1.0745)\ (9.61)}{-11.52} = 0.8964$. $R^2 = 0.803\ 533$, $R^3 = 0.720\ 287$. $R' = 0.8968$. $R'' = 0.896\ 81$.

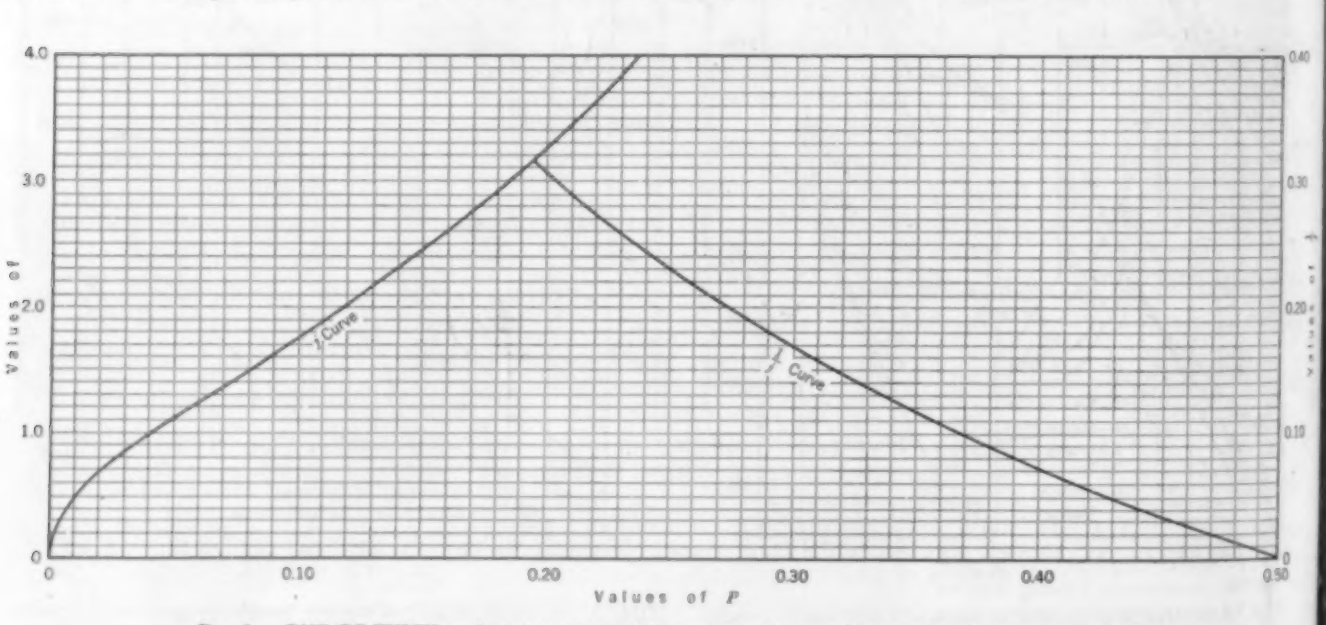


Fig. 1. ONE OF THREE real roots is obtained by use of cubic graph when Cardan's solution fails.

. . . THE READERS Write

Advocates Separate Allocation of Consumptive Uses of Colorado River Water

TO THE EDITOR: In the last paragraph of Mr. McPhail's paper on the power and irrigation potentials of the Colorado River system, in the August issue, he states that there is not enough water in the river system to permit the development of all possible irrigation projects in the river basin. No one, I believe, will quarrel with this opinion. On the other hand, there may well be disagreement with the Bureau of Reclamation's expressed policy of combining power and irrigation projects to make possible the repayment of irrigation costs that otherwise would be prohibitive.

In a state of nature the total average flow of the Colorado River and all its tributaries was somewhere between 16 and 18 million acre-feet per year. However, there is a common saying in the West that one cannot irrigate with averages; it is necessary to use water in a drought. It is doubtful if an annual consumptive use of more than 15 million acre-feet could be maintained throughout a long series of dry years. Losses from reservoirs must be included in such consumptive uses.

The Bureau of Reclamation, in its report of March 1946, entitled *The Colorado River*, makes almost no reference to evaporation losses from reservoirs, and Mr. McPhail states only that, "except for the increase in evaporation resulting from the formation of reservoirs, power projects would not make consumptive use of the water in the river." From this it might be assumed that such losses were not significant. Actually, almost 10 percent of the total natural flow of the Colorado River and its tributaries is now being lost by evaporation from reservoirs, and if the comprehensive plan sponsored by the Bureau of Reclamation is carried out, such losses will be more than doubled.

Allocation of such consumptive uses should be made separately to power and to irrigation. Allocation of such losses between the Upper Basin and the Lower Basin and between the states of California and Arizona must be made before any new projects are undertaken.

For example, Glen Canyon Dam would be just above Lee's Ferry, the point of division between the Upper and Lower Basins, as defined in the Santa Fe Compact. Evaporation losses from the proposed reservoir might amount to 250,000 acre-ft per year. No land in the Upper Basin would be irrigated from this reservoir, but the power produced would presumably serve the entire region. Will the Upper Basin be given credit for the evaporation loss from Glen Canyon Reservoir in any determination of the minimum quantity of water required by the compact to be delivered at Lee's Ferry, or will such evaporation loss be held the responsibility of the upper Basin? As a further example, the proposed power developments at Bridge Canyon and at Marble Canyon would result in increased evaporation losses of at least 150,000 acre-ft per year. These dams are in the state of Arizona, but the bulk of the power developed will presumably be transmitted to California. Will such losses be charged against Arizona's share of the waters of the Colorado River system, or will California assume part or all of this burden?

In the Lower Basin, evaporation from the reservoir above Imperial Dam is obviously chargeable to irrigation. Evaporation from Lake Havasu, on the other hand, should be chargeable almost entirely to the development of power, even though The Metropolitan Water District of Southern California diverts from this reservoir and water may be pumped from it for delivery into central Arizona. Hoover Dam, of course, was built for flood control, conservation, and power development. As reservoir capacity allocated to flood control is normally empty, evaporation losses chargeable to this item cannot be great. Conservation and regulation for irrigation could have been accomplished with much less storage than was provided. A major part of the great loss from Lake Mead should thus be a charge against the cost of power.

The reservoir to be formed by Davis Dam, now under construction, will result in increased evaporation loss which should be allocated to power, even though this dam is required by the treaty between the United States and Mexico, because the primary and substantially the sole purpose of the reservoir is to re-regulate water released from Lake Mead in accordance with power demands. Evaporation from the series of reservoirs to be formed in the Grand Canyon in Arizona and at sites in southern Utah should likewise be a charge against the cost of development of power, except as one of the dams may necessarily be used both to create power head and for the diversion of water to an irrigation project.

In brief, the development of power along the Colorado River and its tributaries will of necessity result in the consumption of a very substantial portion of the only supply of water available for irrigation in one-twelfth of the area of the continental United States. The value of every drop of such water so lost, which could otherwise be made usable for irrigation and domestic purposes, should be a charge against the cost of power produced on the river in competition with alternate sources of energy. The magnitude of the proper charge may be judged from the fact that evaporation losses from the new reservoirs sponsored by the Bureau of Reclamation for the development of power in the Colorado River Basin will be greater than the total water supply of the Salt River Project in which half of the agricultural wealth of Arizona is produced.

Accordingly, in any determination of the economic feasibility of these power developments that must compete with other present and future sources of energy, the value of the water lost by evaporation from reservoirs, which would not otherwise have been consumed nonbeneficially, should be included in the cost of energy delivered from these plants. On the other hand, electric energy supplied to domestic, commercial and industrial users throughout the region, should not be burdened with part of the cost of extraneous works merely to make a showing of feasibility of irrigation projects on which the cost of water would otherwise be prohibitive. In other words, each physically independent unit in the plan sponsored by the Bureau of Reclamation should justify itself. No unit in the program should have to be subsidized by the many for the benefit of a few.

RAYMOND A. HILL, M. ASCE
Los Angeles, Calif.

[*Editors Note: Mr. Hill's discussion and Mr. McPhail's paper were presented originally at the Society's 1947 Spring Meeting in Phoenix.*]

States Water Works Must Face Critics

DEAR SIR: When an industry or profession gets so self-satisfied that it treats honest criticism as an insult, then that industry or profession is riding for a fall. This self-satisfied attitude has been adopted lately by spokesmen for the water-works industry and that segment of the civil engineering profession connected with the design and construction of the plants producing industrial and municipal water.

By means of nation-wide speech-making tours and the publication of a "white paper," spokesmen for the industry have minimized the effect of pollution on the safety and quality of public water supplies. They have implied that any criticism of the water-works industry or its methods or product is not only unjustified but downright dangerous on the ground that it undermines public confidence in its water supply.

The cause of the furor was an article, entitled "Foul, But You Drink It," which appeared in the September issue of the *Woman's Home Companion*. The article dealt with the effect of increased stream pollution on the problem of producing large quantities of safe water. It pointed out that the job is becoming more difficult year by year and that stream pollution is a major water-supply problem.

Engineers know perfectly well that the water-works men are producing water that meets U.S. Public Health Service standards and that water-borne germ diseases like typhoid are at a low point. The best proof of the efficacy of modern purification practice is the general health of the population with respect to typhoid.

However, before defending the industry indiscriminately and issuing "white papers" to whitewash it, there may be good reason for a factual, unsensational study of water-works design and practice, especially in reference to outbreaks of gastro-enteritis. Studies by the USPHS (House Doc. 266, 78th Cong., 1st Session, pp. 1221–1272) have indicated that combined filtration and chlorination is not nearly so effective in reducing mortality rates due to "diarrhea and enteritis" as it is in reducing "typhoid fever" (p. 1242, *ibid*).

The designers of water works for cities using polluted rivers as a source of supply should take action to handle the virus, or organic toxins, causing enteritis. Officials of water-works organizations, instead of attacking the magazine that published the article, the people who got sick, and the methods of reporting the illness, would do well to reexamine the whole situation with a view to improving conditions and procedures that are found inadequate. There are substantial grounds for doubting whether the test for coliform organisms is sufficient basis for giving a water supply a clean bill of health.

The writer suggests that a Society committee be established to look into the entire matter and that funds be obtained for the USPHS (or a qualified outside agency) to do extensive field work and to offer suggestions for the correction of unsatisfactory conditions or procedures. Let the water-works industry refrain from self-congratulations and resolve to continue to improve its practices. That is the engineering way of meeting criticism. Actions speak louder than words.

R. G. KAZMANN, Assoc. M. ASCE
Columbus, Ohio

Urges Clarification of Income Tax Law Affecting Americans in Foreign Service

DEAR SIR: I was much interested in the article, "Income Tax Requirements Affect Foreign Service of American Engineers," by Edmund H. Lang, Assoc. M. ASCE, in the October number. I happen to have had some foreign experience under the provisions of the Internal Revenue Code, and am about to enter such service again. The present law, as interpreted by the Commissioner of Internal Revenue, would have a considerable effect upon the conditions of this service and the compensation received.

I was employed by a South American republic from 1938 to 1940. On preparing my first income tax return in this employ, I took it to the American Consul for checking and instructions. He informed me that since my salary was derived from foreign sources and since I had resided outside the United States for more than six months of the year, I was not obliged to pay a tax upon it. I simply noted the facts upon my return and they were accepted.

In the tax law of 1942 a change was made. In order to qualify for this exemption, the taxpayer had to satisfy the Commissioner of Internal Revenue that he was a bona fide resident of a foreign country for the entire taxable year (which in all ordinary cases is equivalent to the calendar year), that the services for which he was paid were performed outside the United States, and that the income received was paid by other than the United States or any of its agencies. On the other hand, if the taxpayer is employed in any possession of the United States or stationed there on government service, as in the case of military personnel, or engaged in business in such a possession even for a portion of the taxable year, he pays no tax upon income earned provided that such income amounts to at least percent of his entire income.

The whole difficulty at present lies in the ruling of the Commissioner that the term *bona fide residence* must mean *permanent residence*—that is, that the taxpayer must be making a career of foreign service and must have no intention of returning to the United States, except for vacations and business trips. This is in spite of the phraseology of the law, stating that such residence must be for the entire taxable year and providing no tax upon foreign-earned income in the year that the taxpayer returns to the United States, provided he has been non-resident for two years or more, regardless of the fact that he may have been away for only a part of the year in which he returns.

Having a very personal interest in the matter, I visited the Internal Revenue Bureau in Washington and discussed the ruling with an agent. He said that the section of the law is not clear and has given the bureau much trouble. Many persons, including those sent abroad by the government or by business firms, have misinterpreted its provisions and failed to declare their income. The stringent ruling was made to head off illogical claims, but the bureau will judge each case upon its individual merits, so that there is still a chance for tax exemption upon the earnings of a person legitimately employed abroad.

The taxpayer should write to the Commissioner, stating the circumstances of his case, the name of his employer, the class of work that he will perform, the source of his salary, whether he will be accompanied by his dependents, and the probable duration of his absence from the United States, and request a ruling. A copy of the ruling obtained should accompany his next tax return. Under the present law, if the taxpayer enters upon foreign service during any year, he cannot hope to avoid a tax upon his earnings for the remainder of the taxable year. He should have his foreign residence established by or before the beginning of the year. The regulations specify that, once he has established such residence, any number of absences in the United States for vacations or business purposes do not change his status.

Even so, under the Commissioner's ruling, there is a strong chance that foreign salaries may be taxed, depending upon the decision in each case. Thus the Bureau, by this ruling, has largely written its own law, the opportunity being afforded by the defects in the law itself. The agent with whom I talked said that the Bureau would welcome legislation to clarify the section in question.

The ruling, if rigidly enforced, would have a far-reaching effect upon the work of American engineers in the foreign field. Primarily, it would reduce the income of engineers receiving salaries of $15,000 to $25,000 a year by 30 to 40 percent, causing many of them to refuse foreign employment unless guaranteed salaries sufficient to pay the taxes and leave a satisfactory return. This would increase engineering costs to the country seeking to employ them.

If the project does not justify such an increase in engineering cost, the foreign country might abandon it. Or such a country could turn away from American engineers and employ Europeans. This would close the market to use of American goods as well as American labor.

In some cases, foreign countries desiring to employ American engineers on important work of considerable duration may offer them citizenship, and some who consider the attitude of the Internal Revenue Bureau unfair may accept. The American Consul to whom I submitted my first tax return in South America said that the original exemption law had been adopted to keep Americans from becoming expatriates. Some persons living abroad and receiving their principal income from foreign sources had been giving up their American citizenship because of the existing law taxing their income. The ruling of the Commissioner would thus result in a condition that the law was originally adopted to prevent, and the Bureau would collect no income tax upon their salaries.

There remains another possible course of action. A foreign country might refund to an American employee the United States income tax upon his salary or increase his pay so that his net return would not be reduced by the tax. This would be, in effect, a tax upon the foreign country and not upon the employee.

I discussed the matter with the Chief Clerk of the Congressional Joint Taxation Committee, who drafts proposed tax legislation. He confirmed the statement of the Internal Revenue Agent first interviewed, that the law is not clear, has given much trouble, and should be changed. He asked the writer for recommendations, which were compiled and sent in by letter, as follows:

"The existing law affecting taxation of salaries paid to American citizens from foreign sources is stated in the 'Supplement to Regulations 111, Income Tax, Internal Revenue Code, (Sec. 116 (a), (1), (2), and (3),' page 265.

"I believe that it is not equitable to tie in the exemption with the term of the taxable year, since by the accidental circumstance of starting such work at very slightly differing dates, one such employee might have his earnings exempted for an entire two-year period, while another, working for the same length of time, would pay a tax upon his earnings for practically half this period. If such salary is to be tax-exempt, it should be by the reason of the foreign residence and source of income, and not by reason of the dates between which it is earned. I also believe that the necessary bona fide character of the foreign residence may be established by requiring that it be maintained for a reasonable period, say for two years.

"Without attempting to phrase the wording of such an act, therefore, I would suggest that it provide for the exclusion from gross income of earnings of U.S. citizens residing in foreign countries and receiving their pay from sources without the United States (except as paid by the U.S. or its agencies), if the period of employment is two years or more, as evidenced by a contract for his services, a guarantee of salary for such period, by entering upon work estimated to require two years, or other evidence satisfactory to the Commissioner of Internal Revenue. It may be required that such evidence be attached to his first income tax return submitted after entering upon this employment.

"It should also be provided that in cases where a citizen has entered upon such employment in good faith but, after having served for at least one year, is prevented from serving the full two years by reason of death, disabling illness, cancellation of the contract by his employer, completion of the work in less than the estimated time, or from other reasons beyond his control, the Commissioner of Internal Revenue may, at his discretion, waive the two-year requirement.

"The present regulation, to the effect that once the status of bona fide resident of a foreign country is established, it shall not be changed by temporary absences in the United States due to vacations or business trips to the United States should, I believe, be written into the Act."

It is hoped that this letter may initiate action leading to a clarification of the present law or, at least, that it may be of assistance to engineers contemplating entering foreign service.

ERNEST F. ROBINSON, M. ASCE
Winchester, Va.

Bethlehem Is Credited with First Water Works in U.S.

TO THE EDITOR: Readers of CIVIL ENGINEERING may be interested to know that regular operation of the first pumped water works in the United States began in Bethlehem, Pa., in 1755. In this connection, I have done some research into the life of Hans Christiansen, immigrant millwright, who played an important role in the development of a water supply system for the community.

In 1754 the water committee of the Moravian Brethern, who 13 years before had selected Bethlehem as a good site for a settlement because of the presence of an adequate supply of spring water, met to discuss the problem of finding an easier way of bringing water from the spring than by human carriers with yokes on their shoulders. The problem also engaged the attention of Hans Christiansen, who had emigrated to America from Holstein in 1751.

Christiansen observed that water power was available, as an oil and bark mill had been built on the Monocacy Creek close to the spring, and decided that the water wheel could do more work. However, there were other problems to consider, such as the construction of a water tower on top of the hill and of one or more small distribution tanks. There was also the matter of laying pipes to carry the water to the tanks and of deciding what kind of material was available for the pipes. However, construction of the necessary pump constituted the most serious problem.

About this time a West India missionary, John Boehner, was on a visit to Bethlehem. He, like Christiansen, was an ingenious man and interested in mechanical appliances. Boehner made a model of a pump and discussed its merits with Christiansen, who then set about the task of constructing a pump entirely of wood. The piston, 5 in. in diameter, was shaped out of lignum vitae, a dense hard wood.

Meanwhile selected trunks of hemlock, from which water pipes were to be made, were rafted down the Lehigh River from Gnadenhuetten (near the site of the city of Lehighton), a distance of about 30 miles. Christiansen had these logs bored and a tenon formed on one end and the other end mortised. The bore was about 6 in. in diameter, and each log was at least 15 ft long.

While the pump was under construction, a building was erected near the oil mill to house the water wheel that would furnish power for the pump.

The machinery was perfected, a separate water wheel installed, and the pipes were laid. A shingle-roofed wooden water tower, crowned with a weather vane, was built in the "square" (now the site of the Central Moravian Church), as were the smaller distribution tanks.

On May 27, 1755, water was successfully forced up to the water tower, a height of 70 ft, and on June 27 the flow into the tower began. It was a gala day, for nothing in Bethlehem in those days excited public interest so much as the water works. The occupation of the water carriers trudging up the hill from the "well of Bethlehem which is by the gate" was at an end, a tribute to Hans Christiansen, the ingenious millwright. Christiansen died of consumption, as recorded, in Lititz, Pa., on September 15, 1776, and was buried there.

An illustration of the layout of the water works appeared under my name in the ASCE TRANSACTIONS, Vol. 92, 1928, p. 1285.

HARRY G. PAYROW, M. ASCE
Assoc. Prof., Sanitary Eng., Lehigh University
Bethlehem, Pa.

SOCIETY NEWS

R. E. Dougherty Inaugurated as ASCE President

MORE DEFINITE COORDINATION and crystallization of the functioning of the Society's national officers and directors, to the end that the Board of Direction can obtain "some better idea of the thinking of the Society in advance of submitting important amendments or of reaching other momentous conclusions," was advocated by Richard E. Dougherty, vice-president, New York Central System, upon his inauguration as President of ASCE.

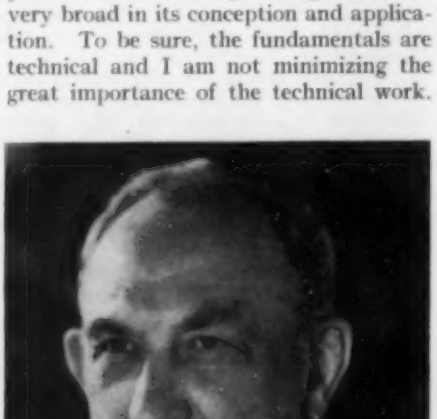
When he took office at the opening of the Society's 95th Annual Meeting in the Hotel Commodore, January 21, Mr. Dougherty made the following brief remarks:

"No man could be more keenly appreciative of the high honor which this Society has this morning conferred on me. Neither could any man be more cognizant of the obligations and responsibilities which that trust imposes. My immediate predecessor, Ed Hastings, and in turn his predecessor, Winans Horner, have indeed set high standards to follow. In fact, that same comment might well be extended to all the Presidents and Past-Presidents with whom I have been associated: Jack Stevens, Malcolm Pirnie, Ezra Whitman, Ernest Black, in the years since 1942, and Robert Ridgway, George Davidson, John F. Stevens, Lincoln Bush, Anson Marston and John Coleman during the years 1928–1929–1930, when it was my privilege to be a Director.

"President Hastings and the 1947 Board may well be proud of having initiated the move which resulted in the enfranchisement of Juniors. There is nothing more important to the Society than its relations with the Juniors and the Student Chapters, and such activities may well be further developed.

"I have no inclination to express dogmatic opinions as to policies which later experience might well prove should be changed. There are, however, certain suggestions which I should like to submit for consideration. The functioning of the Board with the Local Sections and the members, and through the Vice-Presidents in the Zones and the Directors in the Districts, should be more definitely coordinated and crystallized so that the Board could, if possible, obtain some better idea of the thinking of the Society in advance of submitting important amendments or of reaching other momentous conclusions.

"It has always been my idea that the profession of civil engineering should be very broad in its conception and application. To be sure, the fundamentals are technical and I am not minimizing the great importance of the technical work.



RICHARD E. DOUGHERTY
President for 1948

My own thought is that our duties to the profession are much broader and extend to every phase of executive consideration, governmental and otherwise, when our membership is involved. With that objective, it is necessary to work in close cooperation with the other technical and professional societies to accomplish the purposes of the profession and in satisfaction of the trust which I believe the public reposes in us.

"The members of this Society with varied opinions want such things as more consideration for the Local Sections, greater activity in the Engineers Joint Council, attention to the welfare of members, more extensive publications, greater support of the Technical Divisions, Juniors and Student Chapters, and other expansion of activities too numerous to mention. The Engineering Societies Library Board believes that its activities should be expanded.

"In attempting to respond to the ve... ous demands of the Society, previou... Boards have adopted deficit budge... with, thus far, no adverse result with th... exception of depletion of reserves. Thi... cannot go on forever and the 1947 Boar... adopted the wise decision of balancin... its budget and made reductions much t... the dissatisfaction of many member... In my opinion they had no alternativ... It is of interest to observe that less tha... 50 percent of those eligible voted on th... important question of increasing the due...

"I believe that the 1948 Board shoul... carefully review all problems and en... deavor to reconcile the needs and desir... of the Society with the revenues available... It must be remembered the dues hav... not been raised since 1921 although th... ideas of the Society as to its function... have expanded and changed to a vas... extent in the intervening period.

"I believe that the days of complacen... and happy security when the Socie... could afford to wait for prospective mem... bers to apply, have gone. It would b... my suggestion that the Local Section... make strenuous efforts to increase th... Society's membership by interesting an... inviting applications from the leading... engineers in their territories. If th... leading men respond, the younger me... are likely to follow. It would be m... further suggestion that the Local Sec... tions expand their own membership s... that it will not remain only about ha... of the total membership of the Society a... at present.

"In behalf of the 1948 Board I ask fo... your very active help, cooperation and in... terest."

Each year in the issue of CIVIL ENGINEERING immediately following the An... nual Meeting, there appears a biograph... cal sketch of the new president of th... ASCE. This year the biographical ma... terial concerning Mr. Dougherty is be... combined with his inaugural statement... in order that the membership may hav... an opportunity to know a little mo... about the man who heads the Society.

Born in New York City on February 2... 1880, Mr. Dougherty received his ele... mentary and secondary education in th... New York public schools. He then at... tended the City College of New York fo... three years and Columbia University fo... four years, graduating with the degree...

Civil Engineer in 1901. He is a member of the honorary engineering society, Tau Beta Pi, of Columbia. In 1945 he received the Egleston Medal and Citation of the Columbia Engineering Schools Alumni Association for distinguished engineering achievement. He taught at Columbia in 1901 and 1902, and from 1916 to 1920 was special lecturer at Cooper Union.

Associated with the New York Central System since 1902, Mr. Dougherty was recently elected vice president-assistant to the president. He entered the service of the Mohawk Division, located at South Schenectady and Albany, and served as rodman, transitman, and assistant engineer on construction, from 1902–1904. In the years 1904–1905 he was assistant engineer, General Office, New York. From 1905 to 1918 he was in charge of construction, Eastern District, comprising the Hudson, Harlem, Putnam Divisions and New York Harbor, as resident engineer, 1905–1907; assistant district engineer 1907–1910, and district engineer, 1910–1918. From 1918 to 1924 he was designing engineer, Buffalo and East; from 1924 to 1926, engineering assistant to the vice-president in charge of operation, New York Central Railroad, including Ohio Central Lines; and from 1926–1930, engineering assistant to the president, New York Central Lines, including subsidiaries. Mr. Dougherty was elected vice-president, improvements and development, New York Central System, February 1, 1930, and on September 1, 1947, he was elected vice president-assistant to the president.

In addition to general assignments as assistant to the president, he has supervision over engineering activities and maintenance of way standards, real estate transactions, valuation, insurance, development of various problems requiring analysis, consolidations, coordinations, abandonments, etc. He also has supervision over Grand Central Terminal real estate which, in addition to Grand Central Terminal concessions and office buildings, includes other office buildings, apartment houses, and hotels.

During World War II, Mr. Dougherty acted as one of the New York Central's principal contact officers with the Army, Navy, Defense Plant Corp., and other government agencies in locating plants and industries. He also served as principal contact officer with the Transportation Corps of the Army in the organization of four railway battalions of the Military Railway Service, which later served in Africa, Italy, the European Theater, and India. From 1942 to 1945 he was chairman of the New York Central's Research Council for consideration of postwar problems.

In 1946 Mr. Dougherty was elected president of the Lakefront Dock and Terminal Railroad Co., a joint company formed by the New York Central and the Baltimore and Ohio for the construction and operation of a new coal and ore terminal on Lake Erie at Toledo. In the same year the railroads of Chicago now using the four passenger terminals on the South Side—the LaSalle, Dearborn, Grand Central, and Illinois Central—formed the Chicago South Side Railway Terminal Committee consisting of railroad presidents to consider the Chicago Terminal problem, and Mr. Dougherty was designated chairman of the engineering committee to direct investigations and studies.

Since 1935 Mr. Dougherty has been chairman of the Grade Crossing Committee of the Association of American Railroads, acting for all the railroads in cooperation with the Public Roads Administration and otherwise dealing with grade-crossing problems. Mr. Dougherty is also a member of the Committee for the Study of Transportation appointed by the Association of American Railroads to consider postwar problems, and chairman of the executive and operating committees of the Associated Railroads of New York State, handling legislative questions.

A member of the ASCE since 1903, Mr. Dougherty served as Director from 1927 to 1930 and as Vice-President in 1944 and 1945. From 1945 to 1948 he served as a Society representative on United Engineering Trustees, Inc.

His other affiliations include membership in the American Railway Engineers Association, which he served as director from 1945 to 1947, the New York State Society of Professional Engineers and Land Surveyors, and the New York State Chamber of Commerce. Mr. Dougherty served on Mayor La Guardia's Business Advisory Committee and Committee on Ports and Terminals, New York City, and is now a member of Mayor O'Dwyer's Advisory Committee on Port Planning. He is also first vice-president of the West Side Association of Commerce of the City of New York.

Mr. Dougherty has been active in the civic affairs of White Plains, N.Y., where he makes his home. He was on the Board of Education from 1915 to 1935, and president of the Board from 1923 to 1935. He has served as president of the Board of Governors of the University Club of White Plains, and was a member of the White Plains Postwar Planning Commission from 1942 through 1945.

New Officers Installed at New York Meeting

Fifteen Sessions of Technical Divisions Feature 95th Annual Meeting

WITH A TOTAL attendance of almost 2500, the 95th Annual Meeting of the ASCE got off to a good start in the Hotel Commodore, New York City, on January 19. Discussion of subjects of social and professional importance as well as technical sessions featuring a symposium on the Panama Canal, marked the four-day meeting.

Richard E. Dougherty of New York City was inducted into office as President of the Society at the Wednesday morning business session. Brief remarks made by Mr. Dougherty at his inauguration, as well as a biographical sketch of the new president, are given in the preceding item. Also installed were two Vice-Presidents—Carlton S. Proctor, New York City, Zone I, and John S. Cunningham, Portland, Ore., Zone IV—and six Directors: William McK. Griffin and Edmund A. Prentis, New York City, District 1; Joel D. Justin, Philadelphia, District 4; Julian Hinds, Los Angeles, District 11; Webster L. Benham, Oklahoma City, Okla., District 14; and C. Glenn Cappel, New Orleans, La., District 15.

Honorary memberships and prizes also were awarded at the Wednesday morning session. These awards are the tangible means used by the ASCE to recognize outstanding accomplishments in professional engineering fields. The new Honorary Members are:

John B. Challies, vice-president, Shawinigan Water and Power Co., Ltd., Montreal, Canada.

Hardy Cross, professor of civil eginneering, Yale University, New Haven, Conn.

William H. McAlpine, special assistant to the Chief of Engineers, Washington, D.C.

Karl Terzaghi, professor of the practice of civil engineering, Harvard University Graduate School of Engineering, Cambridge, Mass.

The ten members who received prizes and medals for their outstanding contributions to ASCE publications are:

Norman Medal, Boris A. Bakhmeteff,

professor of civil engineering, Columbia University, New York, and William Allan, dean of the School of Technology, City College of New York.

J. James R. Croes Medal, Thomas R. Camp, consulting engineer, Boston, Mass.

Thomas Fitch Rowland Prize, R. F. Blanks, materials and testing engineer, U.S. Bureau of Reclamation, Denver, Colo., and H. S. Meissner, civil engineer, Materials Laboratory, Bureau of Reclamation, Denver.

James Laurie Prize, Ross M. Riegel, head civil engineer, Design Department, Tennessee Valley Authority, Knoxville, Tenn.

Collingwood Prize for Juniors, F. L. Ehasz, consulting engineer of New York City.

Rudolph Hering Medal, A. L. Genter, consulting engineer of Baltimore, Md.

J. C. Stevens Award, Maurice L. Albertson, associate professor of civil engineering, Colorado Agricultural and Mechanical College, Fort Collins, Colo.

Karl Emil Hilgard Prize, A.A. Kalinske, engineer for Infilco, Inc., Chicago, Ill.

The Wednesday luncheon featured an address by William L. Batt, president of SKF Industries, Inc., and former vice-chairman of the War Production Board. An authority on postwar European problems, having served abroad on several official missions, Mr. Batt spoke on the timely subject, "How Engineering Can Aid the European Recovery Plan." His talk is briefed on page 25 of this issue.

The how and why of converting the Panama Canal into a sea-level waterway, with the present locks and dams eliminated in order to meet the threat of atomic bomb attack, was presented at the Wednesday afternoon session by Col. James H. Stratton, supervising engineer, Special Engineering Division of the Panama Canal. His paper, together with others in the symposium based on the two-year study leading to recommendations for conversion of the Canal, as recently made to Congress by the Governor of the Canal Zone, is summarized elsewhere in this issue, pages 17–23.

As usual the dinner and dance, held in the Grand Ballroom of the Commodore Wednesday night, was a brilliant affair. The return to greater formality and elegance in ladies' attire made the scene especially gala. Impromptu gaiety was imparted by the booted (but not spurred) delegation of engineers from Texas with their special dances and Comanche war whoops.

LADIES COMMITTEE meets with Herbert Ridgway, member of general Committee on Local Arrangements, to plan events of interest to wives of engineers attending Annual Meeting. Seated, left to right, are: Mrs. William S. La Londe, Jr., Mrs. Thorndike Saville, Mrs. William N. Carey, Mrs. Shortridge Hardesty, Mrs. Morris M. Goodkind, Mrs. Roger W. Armstrong, Mrs. L. H. Csanyi, Mrs. Arthur A. Collard. Standing, in same order, are: Mrs. Raymond L. Brandes, Mrs. Edward J. Cleary, Mr. Ridgway, Mrs. Maurice N. Quade, Mrs. Alfred Hedefine and Mrs. John P. Riley.

The Thursday luncheon, arranged under the auspices of the executive committee of the Construction Division, was addressed by a distinguished group of speakers, including Past-President Hastings; D. W. Winkelman, president-elect, Associated General Contractors of America; Bernard J. Gillroy, New York City commissioner of housing and buildings; Rear-Admiral J. J. Manning, chief of the Bureau of Yards and Docks; ASCE Vice-President Carlton S. Proctor; and J. P. H. Perry, vice-president of the Turner Construction Co. Kirby Smith, chairman of the ASCE Construction Division's Executive Committee, served as toastmaster.

The traditional Thursday evening smoker attracted a capacity crowd. An excellent dinner was followed by a program of entertainment, to which the ladies were invited. Other entertainment provided for the ladies included the Thursday afternoon reception, tea, and fashion show in the Century Room of the Commodore.

A talk entitled "Your ASCE," by R. E. Dougherty, new President of the Society, featured a large Student Chapter Conference on Friday afternoon. Also of interest to the group of 250 delegates from Chapters in the Northeastern section of the country was a forum on job opportunities in civil engineering, in which the situation in private practice, public service, and construction was discussed by specialists in the field. The delegates joined in an open forum on activities of ASCE Student Chapters. This discussion was led by Prof. Jewell Garrelts, chairman of the Metropolitan Section Committee on Student Chapters, and Prof. G. Brooks Earnest, chairman of the Society's Committee on Student Chapters.

A sightseeing excursion by chartered ferry boat, on Saturday, gave the members an opportunity to view the bridges over the Hudson, Harlem, and East Rivers and the installations of the New York Navy Yard despite near blizzard weather. A box luncheon was served.

Many other activities, both formal and planned and spur-of-the-moment, filled the week. Among these were the college reunions, which made use of the presence of so many alumni in the city to schedule luncheons and dinners.

Ten Technical Divisions held one or more sessions. The programs of these sessions are summarized in this issue, pages 17 to 25.

Section's Publication Urges Support for "Loyalty Fund"

UNDER THE TITLE, "65.6 Percent of the Membership," the *Range Finder*, publication of the Indiana Section, ASCE, has the following to say in the lead article of its December issue:

"When the amendment to increase Society dues failed to meet the necessary two-thirds majority, some 65.6 percent of the members who voted cast their ballot in favor of the increase. In order to create additional monies for desirable expenditures other than allocated in a very restricted budget, the Board of Direction has established the Loyalty Fund.

"The Board is to be complimented for its action. It acted on the plurality of the membership, that strong 65.6 percent. That 65.6 per cent are the loyal supporters of their chosen profession. It is that 65.6 percent who are interested in advancing.

"Several Juniors have expressed their willingness to support this amendment if it again comes to a vote now that they have been enfranchised. Therefore we urge that the Board of Direction seriously consider resubmitting this amendment in 1948. In Indiana, 65.1 percent of those who voted, favored the increase in dues. In the meantime, let's support the new Loyalty Fund.

"Withdrawals from the Loyalty Fund shall be made only on the authorization

BADGE OF OFFICE in form of gavel (above) is handed to incoming President R. E. Dougherty by retiring President Hastings at opening session of Annual Meeting in Hotel Commodore, New York.

RETIRING PRESIDENT E. M. Hastings (above, left) presents Honorary Membership award to John B. Challies, vice-president of Shawinigan Water and Power Co., Montreal, while Arthur Surveyer, Hon. M. ASCE, also of Montreal, who presented Mr. Challies to the President, stands at left.

CORDIAL WELCOME (left) into ranks of ASCE Past-Presidents is extended to retiring 1947 President Hastings (at left) by E. B. Black, 1942 President (center), and W. W. Horner, 1946 President.

CREDIT FOR PLANNING Annual Meeting goes to Metropolitan Section Committee on Arrangements. Seated, left to right, are: L. H. Csanyi, Alfred Hedefine, Past-Chairman, M. N. Quade, Chairman, Arthur A. Collard, Ralph W. Atwater, and, standing, Irving F. Ashworth, Raymond L. Brandes, Nomer Gray, Charles B. Molineaux, William S. La Londe, Jr., Brother B. Austin Barry, John P. Riley.

PRESENTATION of medals and prizes is initiated at opening session of Annual Meeting in Ballroom of Hotel Commodore as Sydney Wilmot, Manager of Technical Publications (standing, left), presents William Allan, M. ASCE, and Boris A. Bakhmeteff, Hon. M. ASCE (standing, in that order), for award of Norman Medal. Others taking part in award ceremony are seated at right.

INCOMING BOARD of Direction assembles for its first meeting. Front row, left to right: Edmund A. Prentis, Director, District 1; Joel D. Justin, Director, District 4; William McK. Griffin, Director, District 1; John W. Cunningham, Vice-President, Zone IV; Richard E. Dougherty, President; Webster L. Benham, Director, District 14; Julian Hinds, Director, District 11; Carlton S. Proctor, Vice-President, Zone I; (second row) Daniel V. Terrell, Director, District 9; Frederick W. Panhorst, Director, District 13; William R. Glidden, Director, District 6; E. M. Hastings, Past-President; W. W. Horner, Past-President; C. Glenn Cappel, Director, District 15; William M. Piatt, Director, District 10; Ralph B. Wiley, Vice-President, Zone III; Harland C. Woods, Director, District 3; (back row) W. L. Malony, Director, District 12; Samuel A. Greeley, Director, District 8; Albert Haertlein, Director, District 2; Shortridge Hardesty, Director, District 1; Lewis M. Gram, Director District 7; Roy W. Crum, Director, District 5; Gail A. Hathaway, Vice-President, Zone II; William N. Carey, Executive Secretary.

the Board. Because the integrity of the men selected by us is above reproach and because the intellect and character of these men are of the highest order, the general membership can be assured that any expenditures from the Fund will be investigated wisely. Perhaps the items of most importance are those which will assist the Local Sections, research, and the professional stature of the engineer."

Rated Under New Point Method, Teachers Are Placed in ASCE Compensation Schedule

INCLUSION OF civil engineering teachers' salaries in the ASCE Recommended Classification and Compensation Plan, and utilization of an objective, point-system formula for evaluating teaching positions according to duties, responsibilities and prerequisites, rather than merely by title, were approved by the Society's Board of Direction at its Annual Meeting in New York in January.

Acting on a final report made after a year-long study by its 1947 Committee on Salaries, which in preliminary reports had called civil engineering teachers "distressingly underpaid," the Board adopted the committee's recommendations that:

Teachers appear in the ASCE recommended salary schedule: instructors in Grade 1, with salaries ranging from $2,700 to $3,400, and in Grade 2, with salaries ranging from $3,400 to $4,200; assistant professors in Grade 3, with salaries ranging from $4,200 to $5,100, and in Grade 4, $5,100 to $6,100; associate professors in Grade 5, $6,100 to $7,250, and in Grade 6, $7,250 to $8,600; professors in Grade 7, $8,600 to $10,350, and in Grade 8, $10,350 to $12,600. These grades follow closely those of federal professional employees (see CIVIL ENGINEERING for November 1946, page 510).

Deans of civil engineering schools be provided with rating sheets and other data evolved during the study, for consideration and discussion.

Copies of the committee's report be sent to the Secretary of each of the Founder Societies.

"Teaching salaries should approximate the prevailing rates for practitioners in permanent employment," the committee emphasized in pointing out the need to hold the large number of teachers "who can and will abandon teaching because they cannot live on the salaries paid," and to attract high-grade engineers who could be equally successful in either field.

The question, "Where in the salary scale should teachers appear?" loomed large in its considerations, the committee reported. Its answer is: "The position of full professor and that of division engineer (ASCE Grade 7) demand equivalent prerequisites, duties, and responsibilities. At this stage in teaching and at this stage in practice, the experience already obtained and the technical development already reached are such that the incumbent can thereafter qualify for the highest position in teaching or in practice if he has the opportunity."

Turning to the point values utilized in the study, the committee stressed the fact that "no arbitrary decision has been made in picking the above points of equivalence in the two scales of grades. The practitioner will rate higher in some, and the teacher higher in others, but the score on duties, responsibilities and prerequisites, translated into point values, will be substantially the same."

Under the formula, a maximum of 150 points is assigned to educational background; 150 to previous experience; 400 to responsibilities of the teacher, divided as follows: supervision, 100; policy and methods, 120; public relations, 80; records and reports, 40; and machinery, safety, etc., 60.

In the committee's study, reports were received from 71 of the 104 engineering schools to which rating sheets were sent. In asking the deans to make the ratings, no point values were presented, in order that no influence could be exerted by knowledge of what the ratings might mean in dollars to any individual and that judgment could be centered on requirements for teachers in the various positions.

Acknowledging that spiritual qualities, highly important in teachers, do not lend themselves to point rating, the committee stressed the fact that the factors or characteristics used are designed to rate the position and not the incumbent. The results of the questionnaire distributed by the committee showed the median value of the points assigned to instructor to be 159; to assistant professor, 228; to associate professor, 304; and to professor, 368.

Median salaries reported in these four categories were $2,500, $3,300, $4,000, and $4,600, respectively, as against recommended medians of $3,400, $5,100, $7,250, and $10,350.

Commenting upon the inclusion for the first time of teacher members of ASCE in the Society's recommended salary schedule, the committee asserted:

"The salaries paid teachers have been published recently, and the figures leave no doubt that they should be raised. The publicity that low salaries have received is all to the good, since too often funds are not available for making any increases. Public support must be secured if the money is to be made available. This is equally true whether the source of the funds is a state legislature or the alumni and friends of private institutions."

A. M. Rawn is chairman of the Committee on Salaries, with Scott B. Lill vice-chairman; Charles H. Mottier and Paul Weir, members; and Vice-Presiden Gail A. Hathaway, contact member.

Washington Award Goes to Ralph E. Flanders

U.S. SENATOR Ralph E. Flanders, of Vermont, a mechanical engineer, is the recipient of the Washington Award for 1948. Established in 1916 by the late John W. Alvord, M. ASCE, of Chicago, the Washington Award is given annually to an "outstanding engineer, a citizen or resident of the United States, who has ably served human needs."

Administration of the award rests with the Western Society of Engineers, on the recommendation of a commission representing the four Founder Societies and the Western Society of Engineers. Previous recipients include Herbert Hoover, Charles F. Kettering, and Ambrose Swasey, Honorary Members ASCE, Henry Ford, Orville Wright, and Michael Pupin.

Senator Flanders has been connected with the Jones & Lamson Machine Co., Springfield, Vt., since 1912, and has been its president since 1933. He is also associated in engineering capacities with other machine tool manufacturers and designers. Long interested in economic and social problems, Senator Flanders has written many articles on these subjects. He commenced a term in the United States Senate in 1947.

Presentation of the award is scheduled for February 11 at a dinner in Chicago sponsored by the Western Society of Civil Engineers.

ASCE Director Made Officer of Commission on Large Dams

APPOINTMENT of ASCE Director Joel D. Justin, consulting engineer of Philadelphia, as vice-president of the International Commission on Large Dams, has been announced by Michael W. Straus, chairman of the U.S. Committee on Large Dams. Mr. Justin, who is known throughout the profession for his writings on dam design, succeeds John L. Savage, Hon. M. ASCE, of Denver, Colo., in this office.

The International Commission is sponsoring the Third International Conference on Large Dams which is to be held in Stockholm, Sweden, June 7–9, 1948.

TTSBURGH, scene of ASCE Spring Meeting, April 7–9, with headquarters at William Penn Hotel, features full round of activities for iting engineers, including many social and entertainment events, sessions of eight Technical Divisions, and excursions to points of engi-ering interest. Night view pictured shows famed "Golden Triangle," business section of Pittsburgh. Fill out registration form on page 92.

Pittsburgh Engineers to Be Hosts to ASCE Spring Meeting

Date Set for April 7 to 9

WITH THE COMING of spring, the city of ittsburgh will fling wide the gates of spitality to an influx of civil engineers. he program arranged for the Spring eeting of ASCE to be held in that city, pril 7 to 9, will offer every variety of traction.

Eight of the Technical Divisions have up programs of current and continu- interest to members of the profession. hey are: Air Transport, City Planning, onstruction, Highways, Sanitary Engi-ering, Structural, Surveying and Map-g, and Waterways. A full program of bjects and speakers will be printed in the March issue of CIVIL ENGINEERING.

William Penn Hotel Headquarters

Spacious quarters for the meeting are being provided in the William Penn Hotel, Pittsburgh's link in the Statler chain. The Hotel and Reservation Committee wants to place as many convention goers as possible in the headquarters hotel. To do so requires early registration by those planning to attend. A form is provided so that you can fill out your request for rooms just as soon as you have a chance to talk it over with the wife. **See registration blank on page 92.**

The William Penn will also be the scene of many entertainment events during the days of the meeting. Dinners, parties, smokers and teas are scheduled, along with excursions to points of engineering interest which will give opportunity for sight-seeing in one of the world's great steel centers.

Local Section and Student Chapter Delegates to Confer

Conferences have been set for delegates from both Local Sections and Student Chapters. Special programs will be circulated to the groups concerned.

Consideration of Science Foundation Bill Is Urged

NEW CONSIDERATION OF science re-rch legislation is urged in a letter re-ntly sent to President Truman by the esidents of the five constituent societies Engineers Joint Council, who termed e establishment of a National Science undation "a matter of vital national gency which cannot suffer further de-y."

President Truman vetoed the bill oviding for a National Science Founda-tion sent him by the first session of the Eightieth Congress, though he had repeatedly advocated formation of such a foundation. In his veto message, he particularly criticized the projected organization of the foundation on the ground that it would "vest the determination of vital national policies, the expenditure of large public funds, and the administration of important government functions in a group of individuals who would be essentially private citizens." However, the President urged that Congress "reconsider and pass an acceptable bill."

In their letter, the presidents of the five major engineering societies stated their awareness of the differences in viewpoint that have delayed the enactment of science research legislation, but expressed the belief that there is "substantial agreement on the objectives of the National Science Foundation and in the principles essential to successful organization and administration." They also pointed to the need of obtaining the support of scientists and qualified laymen and asked that these groups be given a responsible place in the foundation's affairs.

Satisfaction Through Service Is Theme of Life Members' Recollections

LIFE MEMBERSHIP in the ASCE was achieved by 236 men the first of this year. As always, receipt of Life Membership is accompanied by a desire to look back upon the years of association with the Society and to indulge in self-analysis regarding the contributions made to, and the benefits received from, the organization.

About half of those receiving Life Membership certificates, most of them at appropriate ceremonies arranged by their Local Sections, responded to letters from Col. William N. Carey, Executive Secretary, ASCE, felicitating them on their eligibility to receive the certificates and to enjoy the dues-exempt status of Life Members. In responding to the congratulations extended on behalf of the Board of Direction, and to the hopes that "for many more years to come you will continue to give the Society the benefit of your valued association and support," many certificate recipients protested that they had taken out of the Society more than they had contributed. Typical of the comments are these excerpts:

"...Then there is regret for opportunities for service neglected for reasons that at the time appeared adequate, but perhaps were not—opportunities which are not likely to come again. But stronger than these memories and regrets is pride in the Society and its services to the profession and to the world. Old in wisdom, but always young in thought and action, may it continue to serve many generations to come!"

"The ancient and noble traditions of the American Society of Civil Engineers, so well sustained by generation after generation, have had a powerful influence on both my professional and personal life."

"Such endeavors as I have made for the Society have indeed been a pleasure on account of the close association with the members. In very recent years it has been a particular pleasure and satisfaction to note the broad service the Society has rendered its membership, through both the officers and the working members."

"At first it startled me that you should consider it a matter of congratulation... but as my mind went back to those early days in my life, and I recalled some of the men with whom I have been privileged to associate through my connection with our distinguished Society, I saw clearly that you are right. It is indeed a matter for hearty congratulations that all those years I have been privileged to enjoy the many advantages which membership in our Society brings. Some, I understand, consider these advantages to consist of just four things—the TRANSACTIONS, PROCEEDINGS, CIVIL ENGINEERING magazine, and the local meetings. Of course such a valuation is absurd, for these four things, valuable as they are, are merely the tangible advantages which the Society gives to us. The intangibles, which vary with different individuals, are beyond price. The more a member interests himself in Society affairs, the greater these intangibles become."

"Time passes so fast that I really had no idea I was anywhere near the date when I would qualify for a Life Membership, but now that the time has come, I can only say that I am happy to have been a member of the Society for such a long and continuous period. Also, that my interest in the Society will always continue. The association has always been very valuable to me, and has proved a great inspiration in my work."

"My membership has meant a great deal to me through the years, although I have not been as active as I should like to have been.... It is gratifying to note that the Society has been much more progressive in recent years...."

"It hardly seems more than yesterday that I was so elated over my admission as an Associate Member.... The 35 years are more like 35 months, and this is probably due to the field in which we labor, where every day is a new adventure and the word monotony is not known. The steps which the Society is now taking to have engineers give a greater interest in civic and political life will be successful."

Life Members on January 1, 1948

Comfort Avery Adams
Daniel Wesley Albert
Alexander Allaire
James Pierrie Alvey
Edward Robert Armstrong
Louis Evans Ayres
William Jones Barden
George Harmon Bayles
John Edward Bebb
Robert Burns Haldane Begg
Nathan Benedict
Ralph Robert Benedict
William Bryant Bennett
John Cecil Black
Alexander Blair
Conrad Meuly Blucher
Frank Charles Boes
Haig Milton Boyajohn
Ealy Grannis Briggs
Dudley Seymour Bright
Joseph Hugh Brooking
John Maughs Brown
Ralph Budd
Oscar Harold Bundy
Joseph L. Burkholder
Myron Carlos Burr
Wayne Joseph Burton
Drury Butler
John Richard Cahill
Charles Edward Cate
George Moseley Chandler
Warren Winthrop Chapin
Wayne Almon Clark
Sheldon Byrne Clement
Abraham Burton Cohen
Charles Judson Colgan
Stafford Xavier Comber
Harold Conkling
Robert Mavin Cooksey
William Pitcher Creager
Foster Baldwin Crocker
Roy Winchester Crum
Edwin Sanford Cullings
Arthur Culver
Pinkney Edward Cunningham
Robert Curtis Cutting
Ralph Bruére Daudt
Wilbur Ward Davis
Charles Edwin Dexter
Frederick William Doolittle
George Evelyn Doyen
Walter Louis Drager
Fred Calvin Dunham
Allan Theodore Dusenbury
John North Edy
Clarence Eugene Ellsworth
Morris Cable Emanuel
Rollo Guy England
Frederick William Epps
Erik Theodore Eriksen*
James George Esch
Thomas Willard Espy
Clesson Herbert Field
Frank Preston Fifer
Stanley Phister Finch
John Kramer Flick
Nicolay Knudtzon Fougner
Charles Kirby Fox
Edgar Raymond Frisby
Willis George Frost
David Smith Gendell, Jr.
Norman Paul Gerhard
Frank Gillelen
William Goldsmith
Samuel Arnold Greeley
John Huston Clark Gregg
Ernest Edmund Grimes
Joseph Watson Gross
George Hagbart Guerdrum
Willard Adams Guild
Homer Huston Haggard
Ward Hall
Eugene Erwin Halmos
Charles Augustus Handeyside
Harvey Lockhart Handley
Sidney Twichell Harding
George Foster Harley
Richard Ambrose Hart
Gage Haselton
John Edward Hayes
Daniel Carlos Hayne
John Strider Hess
Floyd Sinnock Hewes
William Heyman
Thomas Felix Hickerson
Luther Romberger Hoffman
Clarence Decatur Howe
William Glenn Hoyt
Ellis Hudman
William RichardHughes, Jr.
William Whitehead Hurlbut
Jacob Louis Jacobs
Edwin Warley James
Alfred Jones
Owen Meriwether Jones
James Carey Jordan
Samuel Arthur Jordan
Geary Kimbrell
Edward Dyer Kingman
Frank Alvah Kittredge
Roy Alton Klein
Frank Norman Kneas
James Henry Knowles
Ernest William Kohl, Jr.
Clarence Herbert Kromer
Frank Elmer Lamphere
Martin Philippe Lauer
George W. Cass Lightner
Mark Linenthal
James Bennett Lowell
James Duncan Knapp Lyman
Alexander Sydney Lynch
Charles MacDonald
Stanley Macomber
Carl Armor McClelland
Thomas George McCrory
Joseph Newall McKernan
Henry Lyndon McMillan
Carroll Lamb Mann
George Miles March
Claude Percy Marsh
Charles Christopher Martin
Daniel Howard Martin
Evan Search Martin
Lewis M. Martin
Frank Milton Masters
Richard Mather
Edward John Mehren
Hugh Miller
Charles Rea Moore
Ben Stogden Morrow
Ernest James Newton
John Robert Nichols
William Hogarth Robertson Nimmo
John Alexander Norris
L. Oesterblom
Day Okes
Charles William Okey
Robert Franklin Olds
Ole Kjeld Olsen
Wallace Cromwell Allen Palmer
Dorsey Julian Parker
Ralph Leroy Parshall
Harry Gordon Payrow
Boykin Witherspoon Pegues
Howard Eastwood Phelps
John Louis Pickles
Herbert Carleton Poore
Robert Joseph Potts
William Jenner Powell
Bernard Herman Prack
Andrew J. Provost, Jr.
Walter Putnam
Frank Louis Raschig
George William Rathjens
Leroy Norman Reeve
Cecil Latta Reid
Glenn Vernon Rhodes
Rowland Grenville Rice
Charles Potter Richardson
John Jefferson Richey
Warner Irelan Risley
Harry Robinson
William Henry Robinson
Thomas Walton Roby
Joseph Eugene Root
Joseph Jacob Rosedale
Robert John Ross
Alexander Allen MacVicar Russell
Verney Warren Russell
Edgar Kingsbury Ruth
George Arthur Sampson
Walter Max Sanger
Francis Raber Schanck
George Schobinger
Fred C. Scobey
Percy Allen Seibert
John Archibald Shaw
Percy Augustus Shaw
Charles Edward Smith
Chester Kitch Smith
Clarence Urling Smith
Herbert Yates Smith
James Elmo Smith
John Thoms Smith
Clarence A. Snider
Russell Howard Stalnaker
James Gordon Steese
John Bernard Stein
Roe Loomis Stevens
John Dickson Stevenson
Harry Stock
Edward Charles Stocker
Samuel Edwin Stott
Nelson Taylor
Jonathan Ernest Tolf
Clarence Lionel Todd
Frank Thorn Townson
Frank Johnson Trotter
Hubert Southwick Tollock
James Tyler
Benjamin Franklin Vandervoort
Harry Stewart Van Scoyoc
Nathan Thomas Vestal
Edward George Walker
John Abbet Walls
Thomas Robert Walker
James Olin Wanzer
Elwin Streeter Warner
Frank Edwin Washburn
William Lawrence Waters
Charles David Watson
Vernon Gregg Watters
Royal Sylvester Webster
Walter Wallace Weir
Wade Clarence West
Robert Clark Wheeler
Robert Culin White
Chester Greenhalgh Wiley
Edward Charles Wild
Allen Rutherford Wilson
Thomas Harrison Winchester
Harland Clark Woods
William Gordon Wisefolk
Stanley Hubert Wright
Charles Wuest, Jr.
Howard McClymont Yost

* Deceased.

ure, and will redound to the credit of Society and its members. What is , it will bring about a better world in ch peace will be a certainty."

The years have been crowded with t interesting engineering designing development work. There seems to o letup and the future has more posities than all the past as far as I am erned. I do not like to think of the already served but of the developnts yet to be reduced to a practical s."

Your notification that I had lived and dues so long . . . was something of a k. I hadn't realized (and I don't k I will admit it yet) that I belong h the elders."

Although I have been fairly active in iety affairs, I have received much e than I have put into it."

After 34 years of membership in the iety one cannot fail to be impressed h the splendid accomplishments of the nization and the high attainments, fessionally and otherwise, of the perel comprising it."

It will always be regretted by me that active part in the work of the Society been denied me. I hope that my ll contributions have been valuable that the future may present opportity for doing something more than ng dues and voting."

While my activities in the work of the iety have been relatively small, the efits I have received from my membship and my associations have been y great indeed."

As 1912 seems only about last month, will probably take a little time to come ull realization of what it (Life Membership) all means."

. . . I still enjoy the publications, alugh I have been out of the practice of profession for very many years."

I do appreciate your nice letter and tainly do not intend to let my efforts ard the betterment of the ASCE minish in any way. . . ."

I have enjoyed rendering what little ice I could to the profession since that about the only way you can repay what receive during your early years. You er can return the favor to those who ped you, but perhaps one can do someg toward liquidating the obligations passing the service on to those who are nger."

I have always treasured my membership because of the Society's high professional standing and because it has always held itself above partisanship, strife, bickering that so many organizations into. It is my wish that the Society tinue its present high standard in the ire field of its activities and I shall ays be interested in its progress and ievements."

NOTES FROM THE *Capital*

E. LAWRENCE CHANDLER, M. ASCE
Eastern Representative, ASCE

IN THE FIRST few days of the second session of the 80th Congress several legislative bills of importance to engineers came to the forefront.

It will be recalled that S. 526, which would have established a National Science Foundation, was vetoed by President Truman after having been passed by both Houses of Congress in the first session. H.R. 4852, a corresponding bill, has been introduced in the current session by Congressman Priest. This bill provides that the director of the Foundation be appointed by the President with the approval of the Senate, and this removes the grounds for the principal objection raised by the President in his veto of S. 526. Like its predecessor, it includes research in engineering as one of its objectives and should receive the support of engineers.

H.R. 3342, the Mundt Bill, which provides for the international interchange of "persons, knowledge, and skills" and for "public dissemination abroad of information about the United States, its peoples, and its policies" was passed by the House in the first session but never came up for debate in the Senate. It was recommitted to the Senate Committee on Foreign Relations and again has been reported out to the Senate. Prompt action is anticipated.

Inasmuch as the District of Columbia is the only spot remaining in the country without any law covering the registration of professional engineers, it is of interest to note that Congressman Carl Hinshaw, Assoc. M. ASCE, has introduced H.R. 4884, the "Professional Engineers' Registration Act." This bill is the result of long study by a committee of the District of Columbia Council of Engineering and Architectural Societies and has the endorsement of 15 constituent organizations of the Council.

It is probable that development of the St. Lawrence River will again come up for action during the present session of Congress. S.J. Res. 111 has been reported to the Senate by the Committee on Foreign Relations.

Tellers Report on Final Ballot for 1948 Officers

January 14, 1948

To the Ninety-Fifth Annual Meeting
American Society of Civil Engineers

The tellers appointed to canvass the Ballot for Officers of the Society for 1948 report as follows:

For President:	
Richard Erwin Dougherty	7,593
Scattering	13
Blank	16
For Vice-Presidents:	
Zone I	
Carlton Springer Proctor	7,545
Scattering	9
Blank	68
Zone IV	
John Wilbur Cunningham	7,558
Scattering	11
Blank	53
For Directors:	
District 1 (two to be elected)	
William McKenna Griffin	7,555
Edmund Astley Prentis	7,561
Scattering	11
Blank	117
Total votes registered	15,244
Total ballots canvassed	7,622
District 4	
Joel DeWitt Justin	7,568
Scattering	3
Blank	51
District 11	
Julian Hinds	7,572
Scattering	7
Blank	43
District 14	
Webster Lance Benham	7,543
Scattering	17
Blank	62
District 15	
C. Glenn Cappel	7,566
Scattering	1
Blank	55
Ballots canvassed	7,622
Disqualified ballots withheld from canvas	140
Total number of ballots received	7,762

Respectfully submitted,
GEORGE T. GILMAN, *Chairman*
JAMES D. PARSONS, *Vice Chairman*

W. H. Dieck
Rudolph Evers
Francis B. Forbes
George H. Harp
Howard Holbrook
H. F. Hormann
Harry Newman
Frederick W. Ockert
Tellers

NEWS OF LOCAL SECTIONS

Scheduled ASCE Meetings

SPRING MEETING

Pittsburgh, Pa., April 7–9
(Board of Direction meets
April 5–6)

ANNUAL CONVENTION

Seattle, Wash., July 21–23
(Board of Direction meets
July 19–20)

Coming Events

Florida—Meeting at the Hotel Seminole, Jacksonville, February 12, at 7 p.m. G. E. Schofield, chief chemist of Rayonier, Inc., Fernandina, Fla., will speak on the subject, "From Southern Slash Pine to Finished Rayon."

Maryland—Meeting at the Engineers Club, Baltimore, February 11, at 8 p.m. Preceded by cocktails at 6, and dinner at 7.

Metropolitan—Meeting in the Engineering Societies Building, New York, February 18, at 8 p.m.

Northwestern—Dinner meeting at the Minnesota Union, University of Minnesota, February 2, at 6:30 p.m. There will be a symposium on railroads by representatives of the Great Northern Railway, the Northern Pacific, and the Chicago, Milwaukee, St. Paul & Omaha Railway.

Philadelphia—Joint meeting with the metropolitan Philadelphia chapter of the American Public Works Association at the Engineers Club, February 10, at 7:30 p.m., preceded by good-fellowship dinner at 6 p.m. Illustrated talk on the Port of New York Authority by Roger H. Gilman, assistant to director.

Sacramento—Meeting at the Elks Club every Tuesday at noon. No meetings on holidays; special meetings as announced in the "Engineerogram."

St. Louis—Luncheon meeting at the Hotel York, St. Louis, February 23, at 12:15 p.m.

Seattle—Meetings are held the fourth Wednesday of every month at the Engineers Club, Seattle, at 7:30 p.m.

Tennessee Valley—Meeting of the Chattanooga Sub-Section at the Patten Hotel, Chattanooga, March 9; smoker at 5:15 p.m., followed by a dinner and program beginning at 6 p.m. Regular monthly meeting of the Knoxville Sub-Section at the S & W Cafeteria, Knoxville, February 11, at 5:30 p.m.

Texas—Luncheon meeting of the Dallas Branch at the Adolphus Hotel, Dallas, March 1, at 12:15 p.m.

Virginia—Joint meeting with the Central Virginia Engineers Club at Ewarts Cafeteria, Richmond, February 20, at 5:45 p.m.

Recent Activities

CENTRAL ILLINOIS

UNPRECEDENTED OPPORTUNITIES exist for the young engineer just starting his career, Loran D. Gayton, assistant city engineer of Chicago, told members of the Section at a recent joint meeting with the University of Illinois Student Chapter. Mr. Gayton presented some of the highlights of his own engineering career and gave an insight into the many problems, both technical and personal, that a practicing engineer may expect to face. Earl D. Dryfoose, road engineer for the Illinois Division of Highways, described a recent trip to Europe at a joint meeting with the Illinois Association of Highway Engineers, the Illinois Society of Professional Engineers, and the Springfield Engineers Club.

CENTRAL OHIO

ASCE DIRECTOR Daniel V. Terrell attended a recent meeting and outlined current Society activities. In the discussion that followed his talk, the Section unanimously carried a motion recommending that the Board of Direction initiate action as soon as possible to reintroduce the dues-increase amendment to permit the Juniors to express their opinion on the matter. New officers for the Section, installed during the meeting, are: Carl C. Walker, president; Clarence D. Bowser, first vice-president; Joseph F. Barbee, second vice-president; and Howard Bonham, secretary-treasurer.

CINCINNATI

RECENT DEVELOPMENTS in architectural uses of concrete as a building material were covered at a recent meeting by C. C. Singleton, regional structural engineer for the Portland Cement Association at Philadelphia. The speaker used slides to show the many interesting textural effects obtained with concrete, and described its use in decorative moldings and precast panels. Mr. Singleton also discussed the new method of concrete construction in which walls are poured in a horizontal position and then hoisted in place, reducing the amount of time required for the work and the need for skilled labor for formwork.

CONNECTICUT

THE ARMY CORPS of Engineers offers many opportunities for a worth-while engineering career, Brig. Gen. Raymond G. Moses pointed out at a recent meeting held in Hartford. General Moses, who was division engineer for the New England Division of the Corps of Engineers, described the civil works of the Corps in the area. His talk was especially interesting to the members of the University of Connecticut Student Chapter who were guests of the Section for the occasion.

DISTRICT OF COLUMBIA

A COCKTAIL PARTY, substituted during the holiday season for a regular technical meeting, was much enjoyed. There was an attendance of 231 members of the Section and their families and guests.

FLORIDA

ENGINEERS SHOULD DO everything possible to foster the flood-control projects currently contemplated for the central-southern portion of Florida, Col. A. G. Matthews, chief engineer of the Division of Water Surveys and Research for the State of Florida, told members of the Section at their January 8 meeting. In a talk on Florida's water-conservation program, Colonel Matthews stressed the potential asset of the project to the state. At the Section's recent annual meeting, certificates of life membership were presented to Alexander Blair, of Lake Placid, and Vernon G. Watters, of Sebring. A similar award will be made to Alexander Allaire, of Tampa, who was unable to be present. The technical program for the occasion consisted of a talk on American railroading by John Love Wilkes, president and general manager of the Jacksonville Terminal Co. Russell DeGrove is the new president of the Section, and Walter Parks, Jr., secretary-treasurer.

GEORGIA

IN THE FIVE-YEAR period from 1942 to 1947 the annual budget of the Georgia State Engineering Experiment Station at Atlanta increased from $35,000 to about $500,000, Dr. Gerald A. Rosselot, director of the Station, stated at a recent meeting. The speaker gave a brief account of the history of the Station, described the present plant, and showed slides to give the details of the laboratories and research projects. The Station, which works in cooperation with the academic and research staff of the Georgia School of Technology, has present contracts for nearly a million dollars worth of research.

MONTANA

THE FINANCIAL STATUS of the Society and efforts to balance the 1948 budget were outlined at a recent meeting by ASCE Director W. L. Malony, of Spokane. The speaker stressed the expanding professional interests and activities of the Society, pointing particularly to its participation in EJC affairs. In the general discussion that followed his talk, it was the consensus of the group that a proposal for raising dues without the subsidiary matter of changing the New York dues should be initiated at once and brought to vote as soon as possible. The Section's practice of sending out detailed meeting announcements in the form of news letters and of keeping the Director, Vice-President, and Society Field Representative informed of Section activities was commended by Mr. Malony.

DELEGATION FROM ASCE STUDENT CHAPTER at Montana State College meets with Society Director W. L. Malony at special dinner meeting of Montana Section in Helena.

ILLINOIS

PRESENTATION OF certificates of life membership to eight members of the Section featured the annual luncheon meeting. Recipients were John C. Black, Ralph Budd, Samuel A. Greeley, Floyd S. Hewes, Jacob L. Jacobs, Charles P. Richardson, Chester K. Smith, and Roe L. Stevens. New officers, elected during the meeting, are: George S. Salter, president; W. S. Lacher, vice-president; and Howard F. Peckworth, secretary. C. H. Mottier remains as vice-president for another year, and W. E. Busse as treasurer.

KANSAS

A TALK ON stream pollution in Kansas comprised the technical program at a recent dinner meeting. This was given by Ben L. Williamson, chief engineer of the Kansas State Board of Health. Part of the meeting was devoted to business discussion.

KANSAS CITY

WORK OF THE Junior Activities Committee of the Section in organizing the Juniors' highly successful technical programs during the past year was commended at the annual business meeting. A certificate of life membership in the Society was presented to H. L. Handley. Two other recipients—N. T. Veatch and J. H. Brooking—were unable to attend the meeting. The annual election of officers, held during this session, resulted in the choice of Ansel N. Mitchell for president; Josef Sorkin, first vice-president; J. Q. A. Greene, second vice-president; and Mark C. Culbreath, secretary-treasurer.

MIAMI

BULK BUYING AND obtaining of competitive prices would save the city of Miami many thousands of dollars each year, according to John Wilmot, executive of the Dade County Research Foundation, who addressed the January 5 meeting. Citing abuses and inefficiencies resulting from the fact that each city department does its own purchasing, Mr. Wilmot stressed the need for a central purchasing agency. There was some discussion of the feasibility of joining with the Professional Engineers Association of Southeast Florida to form a proposed joint engineering council.

MID-MISSOURI

ASCE DIRECTOR Harry F. Thomson attended the annual meeting at Columbia, which was a joint session with the University of Missouri Student Chapter. The technical program consisted of a talk on current Society affairs by Mr. Thomson and the presentation of four student papers. There was an attendance of 125.

LOUISIANA

A ROUND-TABLE DISCUSSION on how the Local Sections can improve their programs and increase their services to members was led by W. H. Scales, architectural engineer and Southern division manager for the National Lumber Manufacturers Association, at a recent meeting. Several committee reports were presented, and Roy T. Sessums, head of the civil engineering department at Louisiana Polytechnic Institute, discussed the "Career Days" held by the high schools in the northern part of the state. On these occasions the various faculty members of the Institute, which is located at Ruston, meet with groups of high school students interested in a particular career, to advise and guide them.

NORTH CAROLINA

NORTH CAROLINA'S rural-to-urban population switch has strained the water supplies of various municipalities, according to speakers at the Section's recent annual meeting in Greensboro. Engineers from various cities discussed water-supply problems they have encountered with the growth of their communities, and several described projects under way to meet the problem. John Spinks, Winston-Salem consultant, stated that his city must tap the Dan or Yadkin rivers for an adequate supply, and pointed out that the city has voted a $4,000,000 bond issue to improve its supply and avert a recurrence of last summer's shortage. Other speakers included ASCE Director William M. Piatt, of Durham, who discussed Society affairs. During the meeting certificates of life membership were presented to Robert M. Cooksey, of Thomasville; Thomas F. Hickerson, of Chapel Hill; and Carroll L. Mann, of Raleigh. Herman G. Baity was elected president of the Section for 1948; John D. Watson, first vice-president; and B. W. Davis, second vice-president.

NORTHWESTERN

ENGINEERING PROBLEMS encountered in the construction and maintenance of the Twin Cities sewage disposal plant were detailed at the January dinner meeting by Kerwin L. Mick, chief engineer of the Minneapolis-St. Paul Sanitary District, and John C. Sager, engineer of maintenance and design. Prof. George J. Schroepfer, former chief engineer of the Sanitary District, then commented briefly on the early history of the project. Other guests included George S. Salter, ASCE Mid-West Representative, who spoke on current Society activities.

OREGON

A SPECIAL DINNER meeting was recently held in honor of Leroy F. Harza, Julian Hinds, William H. McAlpine, and ASCE Past-President J. C. Stevens, all members of the Consulting Board to the Army Corps of Engineers, who met in Portland to discuss the design of the projected McNary and Lookout Point dams. The speaker of the evening was

ASCE Western Representative Walter E. Jessup, who discussed the EJC report, "The Engineering Profession in Transition."

PANAMA

A TALK ON future plans for the Panama Canal—given by Col. James H. Stratton, of the Special Engineering Division of the Panama Canal—comprised a recent meeting program. The principal speaker at another recent meeting was Dr. James Zetek, entomologist for the U.S. Department of Agriculture, who addressed the Section on the subject, "Termites, Teredos, and Their Relation to Engineering Structures." Section officers for 1948 are: J. P. Smith, president; Tomas Guardia, first vice-president; E. W. Zelnick, second vice-president; and N. E. Wise, secretary-treasurer.

PHILADELPHIA

CHARACTERISTICS OF THE relatively new technique of air entrainment were described by H. F. Gonnerman, manager of the research laboratory of the Portland Cement Association, Chicago, at the January 13 meeting. Although the technique is particularly applicable to road paving, where prevention of surface scaling is the prime objective, it is also being developed for structural use, according to the speaker. Among the advantages the method offers are ease of placement, minimizing of honeycombing, reduced water gain, and better appearance. The extensive research accomplished in this new field was illustrated by a comprehensive group of curves. At another meeting E. C. Gegenheimer, assistant general manager of the Eastern region of the Pennsylvania Railroad Co., presented a history of railroad transportation in the United States and discussed economic and engineering aspects of new types of motor power in rail transport.

SAN DIEGO

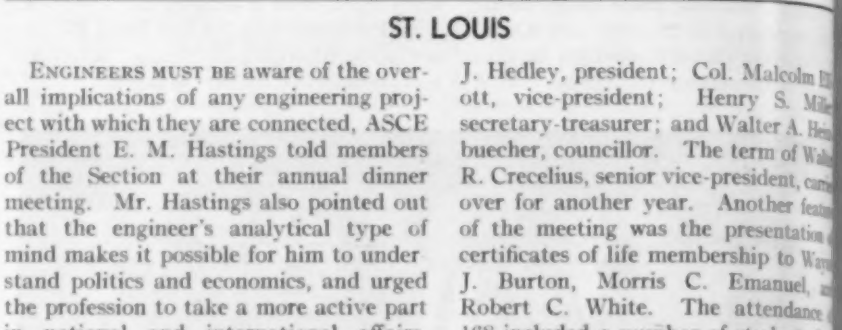
SPECIAL GUESTS AT the Section's annual meeting were ASCE Director John H. Gardiner, Director-elect Julian Hinds, and ASCE Western Representative Walter E. Jessup. Mr. Gardiner and Mr. Jessup spoke briefly on Society affairs, commenting particularly on the recent budgetary changes. The technical program for the occasion consisted of a talk by J. L. Burkholder on the 71-mile San Diego Aqueduct, which has just been completed. Mr. Burkholder, who is general manager and chief engineer of the San Diego County Water Authority, pointed out that the aqueduct is unique in having 21 vertical loops, each with different hydraulic gradients, and crests as open structures. New Section officers are: M. J. Shelton, president; R. S. Holmgren, vice-president; and J. F. Jorgensen, secretary-teasurer.

SEATTLE

TESTS ON CONCRETE culvert pipe recently performed at the University of Washington for the Washington State Highway Department were described at a recent meeting by William R. Mason, engineer for the Columbia Steel Co., Seattle. On the basis of these tests, Mr. Mason said, various changes have been made in the State Highway Department specifications for large concrete culvert pipes. Relationship between test and field conditions were then outlined by R. G. Hennes, associate professor of civil engineering at the University of Washington.

ST. LOUIS

ENGINEERS MUST BE aware of the overall implications of any engineering project with which they are connected, ASCE President E. M. Hastings told members of the Section at their annual dinner meeting. Mr. Hastings also pointed out that the engineer's analytical type of mind makes it possible for him to understand politics and economics, and urged the profession to take a more active part in national and international affairs. During the business meeting the following new officers were elected: William J. Hedley, president; Col. Malcolm E. [illegible]ott, vice-president; Henry S. Mi[illegible] secretary-treasurer; and Walter A. He[illegible]buecher, councillor. The term of Wal[illegible] R. Crecelius, senior vice-president, carr[illegible] over for another year. Another featu[illegible] of the meeting was the presentation [illegible] certificates of life membership to Wa[illegible] J. Burton, Morris C. Emanuel, a[illegible] Robert C. White. The attendance [illegible] 168 included a number of students fr[illegible] the Missouri School of Mines and Wa[illegible] ington University.



ASCE PRESIDENT E. M. HASTINGS addresses recent annual dinner meeting of St. Lou[illegible] Section. Shown, in usual order, are: ASCE Director Harry F. Thomson; William J. Hedle[illegible] newly elected president of Section; Mr. Hastings; and John I. Parcel, retiring Section pre[illegible] dent.

FACULTY MEMBERS AND STUDENTS of Missouri School of Mines are photographed wi[illegible] ASCE President E. M. Hastings, guest of honor and principal speaker at annual dinner mee[illegible] ing of St. Louis Section.

TENNESSEE VALLEY

ALTHOUGH THE Holston Sub-Section is less than a year old, it handled the Section's two-day annual meeting, held at Johnson City, Tenn., in veteran style. Sub-Section President Dudley T. Parr—assisted by Secretary Sidney Smith, George Leonard, Oren Reed, and Jack McKamey—was in charge of local arrangements, and the over-all planning was handled by George Palo, program chairman for the Section. Principal speaker at the afternoon session was ASCE Executive Secretary William N. Carey, who outlined recent Society activities, commenting particularly on ASCE participation in EJC affairs and on the present financial situation. A talk on the Watauga Dam project, by George K. Leonard, project manager for the TVA, concluded the afternoon session. Speakers at the Friday evening dinner dance were ASCE Vice-President Gail A. Hathaway, Eastern Representative Lawrence E. Chandler, and Col. E. W. Palmer, president of the Kingsport Press. Saturday morning was devoted to inspection of the Watauga Dam construction site and to witnessing a huge blast of rock for the project. The estimated volume of rock in the blast was 335,700 cu yd, making it the largest ever to be set off. The charge of 520,000 lb of Nitramon was placed in 2,600 lin ft of coyote hole tunnels. William N. Calvert, Knoxville, was elected president of the Section for 1948. Sub-Section presidents, elected at the annual meeting, are shown and named in the accompanying photograph. Sub-Section secretaries are: Clyde A. Needham, Knoxville; Jack M. Terry, Chattanooga; Melvin C. Thomas, Holston; and W. Douglas Lavers, Oak Ridge.

MBERS OF BOARD OF DIRECTION of Tennessee Valley Section are photographed at ent organizational meeting. Shown, left to right, are: Lewis A. Schmidt, 1947 president; rren A. Niles, president of Oak Ridge Sub-Section; Leonard C. Bailey, president of Knox- Sub-Section; Ernest M. Titus, Section secretary-treasurer W. N. Calvert, Jr., 1948 tion president; Raymond L. Moore, president of Chattanooga Sub-Section; Albert B. odwin, president of Asheville Sub-Section; and Sidney N. Smith, president of Holston -Section.

SYRACUSE

THE ARMY'S COOPERATIVE program for training specialized technical units required for efficient operations in national defense was outlined by Maj. John F. Hansell, of the Army Corps of Engineers, at a joint dinner meeting with the Syracuse University Student Chapter. Speaking on the subject, "War Department Affiliated Units Program," Major Hansell emphasized the importance of the program to national defense. ASCE Director Harland C. Woods, of Buffalo, was a guest of the Section for the occasion.

VIRGINIA

MEETING WITH THE Engineers Club of the Virginia Peninsula at Newport News, Va., to discuss the organization of an engineers joint committee in the area, members of the Virginia Section heard ASCE Eastern Representative E. Lawrence Chandler report on EJC activities on the local, national, and international level. In Mr. Chandler's address, entitled "Putting Your Shoulder to the Wheel," he indicated the constructive efforts that should be made to advance EJC and promote closer cooperation among the various branches of the profession. Following his talk, P. A. Rice, Virginia chairman for EJC, reported on local progress to date, as did the other Founder Society representatives on the state EJC committee. W. C. Roberts was chairman of the Section committee on arrangements for the meeting, which was attended by 175.

STUDENT CHAPTER *Notes*

ILLINOIS INSTITUTE OF TECHNOLOGY

TECHNICAL ABILITY IS not enough, ASCE Mid-Western Representative George S. Salter told Chapter members at a recent meeting. Mr. Salter stressed the importance of social contacts and of such extracurricular activities as serving on committees for engineering students interested in getting jobs. He also pointed out the need for better education in economics, sociology, and management subjects. At another of the Chapter's biweekly meetings Leonard P. Zick, Junior Contact Member for the Chapter, also discussed the necessity of associating with one's fellow engineers. Movies on engineering subjects have been much enjoyed at other sessions, and the showing of a technicolor film on the civil engineers' summer camp featured the annual smoker. Chapter officers for the school year are: James H. Old, president; Frank Nelson, vice-president; John J. Vetter, secretary; and Howard Baum, treasurer.

CLARKSON COLLEGE OF TECHNOLOGY

PROF. EMIL A. GRAMSTORFF, head of the civil engineering department at Northeastern University, Boston, and member of the ASCE Committee on Student Chapters, addressed a recent banquet. Other guests included Dr. John P. Brooks, president emeritus of Clarkson College; Jess H. Davis, acting president; William J. Farrisee, dean of men; and William T. Field, Student Chapter Contact Member. Officers of the Chapter are: Robert D. Hilliard, president; Frederick A. Rexford, vice-president; Louis G. Petro, secretary; and Howard E. Lechler, treasurer.

PURDUE UNIVERSITY

MORE THAN 150 new members for the Purdue Student Chapter were obtained as a result of a membership drive. ASCE Vice-President Ralph B. Wiley addressed a recent meeting on the advantages of Student Chapter membership and of early affiliation with the Society. Another recent speaker was Prof. K. B. Woods, director of the Joint Highway Research Project at Purdue, who gave an illustrated lecture on the perma-frost investigations made in Alaska during the past summer under his direction. Present Chapter officers are: Leon Abele, president; Robert Esch, vice-president; Philip Neff, secretary; and James Zervas, treasurer.

UNIVERSITY OF WYOMING

METEOROLOGY IN ITS application to engineering was discussed at a recent meeting of the University of Wyoming Chapter by Jac Logan, of Laramie, former member of the Army Air Force. The Chapter reports that it is currently engaged in a membership drive with very good results. The present enrolment is about 75. Chapter members have been working on a new constitution.

NEWS BRIEFS

PRA Reports Faster Pace Set in 1947 Highway Improvement

IMPROVEMENT of the nation's highways proceeded at a faster pace in 1947 than in the preceding year, according to reports received from state highway departments by the Public Roads Administration of the Federal Works Agency. Reviewing the progress of the highway program, Public Roads Commissioner Thomas H. MacDonald, Hon. M. ASCE, said contract awards authorized by the states during the year called for $895,000,000 worth of work on 44,700 miles of road. This sum was approximately $150,000,000 more than the cost of road construction contracted for in 1946. The 1947 total included contracts for federal-aid projects for 19,800 miles of highways at a cost of $640,000,000. Expenditures for state-administered highway work under way during the year amounted to approximately $890,000,000.

At the year's end, Commissioner MacDonald said, federal-aid projects costing more than $700,000,000 were under construction, and plans had been approved for additional projects costing around $350,000,000, on which work is expected to start this year.

The total estimated cost of federal-aid projects programmed by the states for construction but not yet advanced beyond the planning stage was nearing $750,000,000, commissioner MacDonald stated.

The urgent need for better highways throughout the nation was emphasized by steadily mounting floods of traffic on main rural roads and urban thoroughfares. Motor vehicle registrations in 1947 are estimated to have exceeded 37,000,000, setting an all-time record. This was approximately 3,200,000 more than the 1946 total and 2,644,000 above the number of motor vehicles registered in 1941, the previous peak year. The increasing use of highways for commercial transportation was reflected in the fact that truck registrations rose from 4,859,244 in 1941 to an estimated total of 6,500,000 in 1947, an increase of around 33.7 percent. The increase over the 1946 total of 5,725,692 registrations was about 13.5 percent.

With traffic congestion steadily becoming more serious, one of the most important developments in 1947 from the standpoint of the average motorist was the designation of a 40,000-mile interstate system of highways which eventually will be improved to high standards, Mr. MacDonald said. The system includes routes carrying large volumes of traffic into and through cities (CIVIL ENGINEERING, September, page 55).

Multiple-Purpose Project Is Recommended in Army Report

CONSTRUCTION OF a new dam and powerhouse at Albeni Falls on the Pend Oreille River, Idaho, some 5 miles downstream from its confluence with Priest River, is recommended in a recent report of the Army district and division engineers for the Seattle District, North Pacific Division of the Corps of Engineers.

The report recommends that the Albeni Falls project, consisting of a dam and reservoir to normal elevation 2062.5 ft be adopted at an estimated cost to the United States of approximately $27,000,000 for construction and $100,000 annually for operation and maintenance, both estimates based on 1947 prices. It also recommends that provision be made for future recreation, conservation and public health facilities as may be determined by the Secretary of the Army to be desirable and economically justifiable.

The project will add 251,000 kw of urgently needed firm capability to the regional system of existing and authorized power projects through the use of the stored water in three 14,200-kw units proposed at Albeni Falls and in downstream plants in existence or already authorized by Congress. Increased channel depths during low-water periods in navigable reaches of the Columbia River will result from the new construction.

Aluminum Production Tops Previous Peacetime Records

ON THE BASIS of preliminary figures published by the U.S. Bureau of Mines for the first nine months of 1947, actual production of primary aluminum by the whole U.S. industry during the year is estimated at approximately 1,140,000,000 lb, as compared with 819,260,000 lb in 1946—the greatest previous peacetime-year record—for an increase of more than 39 percent. Thus, according to Roy A. Hunt, president of the Aluminum Co. of America, it appears certain that aluminum will more than maintain its leadership as the first-ranking nonferrous metal of industry from the standpoint of volume produced.

Despite the production records set in 1947, the aluminum supply situation tightened toward the end of the year, particularly in certain mill products such as sheet. Demand for these mill products, over and above what would otherwise be the [illegible] has been chiefly caused by shortages of [illegible] materials such as steel and galvanized [illegible]. Although prices for most other [illegible] have increased sharply, the basic price [illegible] aluminum has decreased a full 30 [illegible] since 1939, Mr. Hunt revealed.

Public Works Contracts Show Marked Increase

CONTRACT AWARDS for state and [illegible] construction increased 35 percent [illegible] the first nine months of 1947, [illegible] $1,591,000,000 as compared with $[illegible] 000,000 during the same period in 194[illegible], according to an announcement of the Fed[illegible] Works Agency. At the time of expir[illegible] of the federal-aid law last year, New Y[illegible] led all other states with a backlog of s[illegible] public works proposals totaling $3,743,0[illegible] 000. Of this total, plans were compl[illegible] for projects valued at $416,000,000. C[illegible] fornia followed with a proposed work p[illegible] gram estimated at $1,941,000,000.

Of contracts actually awarded, New Y[illegible] State also led with a total of $154,00[illegible] and California was again second w[illegible] $134,000,000. Pennsylvania followed w[illegible] $120,000,000; Texas, $102,000,000; I[illegible] nois, $91,000,000; Ohio, $63,000,000 a[illegible] Michigan, $59,000,000. All sections of t[illegible] country except New England showed a d[illegible] cided advance over 1946, the Pacific Sta[illegible] increasing by 66 percent and the So[illegible] Atlantic States by 60 percent. New En[illegible] land's contracts declined by 11 percent.

Industrial Building Decline May Offset Construction Ri[illegible]

RESIDENTIAL CONSTRUCTION, with a va[illegible] of around $6 billion as against $4.8 billion [illegible] 1947, is expected to be the largest single ite[illegible] in the 1948 privately financed building pr[illegible] gram, estimated jointly by the Departme[illegible] of Commerce and Labor at more than $1[illegible] billion, about 75 percent of the total cost o[illegible] $15.2 billion for all new construction. Fa[illegible] building expeditures will be around $[illegible] million or a little more than 10 percent abo[illegible] those of 1947, the same sources indicate.

In the private non-residential field, a[illegible] cording to these government departme[illegible] an estimated increase of $430 million in ge[illegible] eral commercial building may be offset [illegible] 1948 by a decrease of some $340 million [illegible] industrial construction.

Highway construction may again be [illegible] largest item in publicly financed projects w[illegible] an expenditure of $1.5 billion—almost [illegible] percent of the total public works' outl[illegible] estimated at $3.8 billion. Non-residen[illegible] public construction is to cost around $[illegible] million, an increase of more than 60 per[illegible] above the 1947 outlay.

Radar's "Magic Eye" Surveys a Continent

SURVEY BY RADAR of Australia's 3,000,000 square miles of territory is now being undertaken in reorganizing the mapping of that continent under its National Mapping Council. Consisting of the commonwealth's Surveyor-General, an army representative and the surveyors-general of the commonwealth's six states, the Council has assigned the task to the Australian Army Survey Corps and the Royal Australian Air Force survey unit. The continent will be systematically mapped for settlement, regional planning, highways, railways, water supply, mining, forestry, agriculture and irrigation, and all defense service needs will be coordinated.

Officers from the Australian army and air force are in England studying recent advances in radar map technique, developed largely in Southeast Asia during the war, while a special committee of physicists attached to the Council for Scientific and Industrial Research is engaged in research to perfect Australian equipment and investigate factors in radar use peculiar to Australia. Settled areas will be mapped on a scale of one mile to the inch and the hinterland at four miles to the inch.

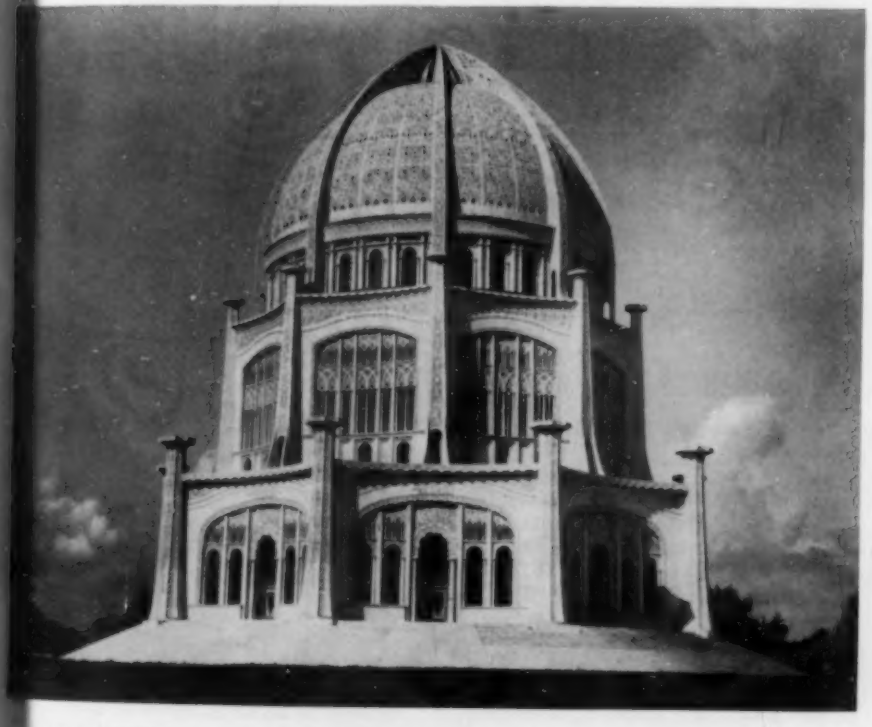
Colonized less than 160 years ago, Australia is largely unmapped in the technical sense. Maps of one kind or another cover the whole continent—some of 8 miles to the inch—but many are based on old and questionable data. Only part of the country, embracing a relatively narrow coastal strip, running roughly from Adelaide through Melbourne and Sydney to Brisbane, has been covered by first-class surveys.

Areas to be charted include the lonely barren center of the continent, the remote north and northwest, and the jungle-clad fastnesses of the Australian mandated islands where field parties would be costly and difficult to maintain. Equipped for a protracted stay, the scientific expedition arriving in the Antarctic toward the end of 1947 will also use radar technique in exploring and mapping the icebound wastes of Australia's possessions in that region.

Adaptation to surveys of radar's "magic eye" is revolutionizing the mapping of great expanses of country, making possible immediate measurement of long distances over which radar waves speed at a rate of 200,000 miles per second, compared to months required to cover such distances in difficult terrain by ordinary survey. With the survey party 150 miles away, camera location is determined by remote control at the moment of exposure within an accuracy of 20 yd. Camera tilt effect on the photograph is measured by photogrammetric equipment and all points of detail are transferred to the conventional map in their true positions.

By these modern methods a complete and accurate map of the Australian continent is possible within the next 20 years.

Structure Features Ornamental Use of Concrete



CONCRETE PROVES ITS ORNAMENTAL as well as structural worth in intricate design treatment that dominates architectural motif of Baha'i Temple, Chicago area landmark. Structure consists of four stories of concrete and steel, covered with ornamental shell. Hundreds of decorative units are cast individually from molds poured with mixture of white portland cement and crushed quartz and joined together to form unbroken surface of outer shell. Resulting ornamental concrete has hardness and endurance of natural stone. Design for ornamentation and finishing of interior of temple will begin in few months on schedule calling for completion in 1953. Preliminary estimates fix cost of interior ornamentation at $500,000 bringing total cost of land and structure to more than $2,000,000. Nearly $1,500,000 has already been expended since construction began in 1920.

Applied Mechanics Congress Meets Next Year in London

AMERICAN ENGINEERS and scientists are invited to attend the Seventh International Congress of Applied Mechanics to be held at the Imperial College of Science and Technology, South Kensington, London, England, September 5–11, 1948.

Technical sessions will be organized under the following sections: (1) elasticity and plasticity; (2) aerodynamics, hydrodynamics, meteorology; (3) thermodynamics, heat transfer, etc.; and (4) vibrations, lubrication, and experimental methods. In addition, as many as ten general lectures or surveys are contemplated on subjects likely to be of interest to members.

Members whose papers are accepted for presentation should provide copies of abstracts for the information of other members. These should be in the hands of the organizing secretary of the Congress as early as possible. The Imperial College has no facilities for reproduction of abstracts of papers.

A registration fee of approximately $5 may be paid at the time of registration or in advance to the organizing secretary at Imperial College. Engineers planning to attend the Congress should contact the Organizing Committee at an early date.

Study of Apprentice Needs in Skilled Trades Is Urged

PREPARATION OF an up-to-date census of the number and distribution of skilled workers in the country, and determination of the number of trained apprentices needed in every community for the steady supply of the skilled trades, were emphasized as industry's greatest responsibilities by William F. Patterson, director, Apprentice-Training Service of the U.S. Department of Labor, in an address at the recent graduation ceremonies sponsored by the Connecticut State Apprenticeship Council.

Pointing out that such a census has not been taken since 1940, and that few apprentices were trained in industrial expansion during the war, Mr. Patterson urged that in every area local management-labor committees or employer organizations and unions ascertain the exact number and age of skilled workers, number of workers needed and number of apprentices in training required for each trade. An analysis should be made each year, he said, to keep the ranks of apprentices filled without being overmanned or undermanned.

Comprehensive Report Recommends Two New San Francisco Bay Crossings

TWO ADDITIONAL San Francisco Bay crossings are needed as essential links in California's highway system, according to the report of Director of Public Works C. H. Purcell, M. ASCE, submitted to the California Toll Bridge Authority following a comprehensive two-year study. This recommendation has been concurred in by the Authority with the emphatic support of its chairman, Governor Earl Warren, according to a recent issue of *California Highways and Public Works*.

The two recommended crossings, selected from 12 included in the study, are estimated to cost $239,468,000, the report states. One crossing—a toll bridge estimated to cost $105,000,000—would run from Rincon Hill in San Francisco to Oakland via Yerba Buena Island, north of and approximately parallel to the existing San Francisco–Oakland Bay Bridge, with a tube under the Oakland Estuary, giving access to the East Bayshore Freeway and the City of Alameda. The other recommended route would be a toll highway—estimated to cost $134,468,000—crossing the bay to the south from the Bayshore Freeway near Army Street, San Francisco, to the southern limits of Alameda, continuing northward across the Oakland Estuary to a connection with the East Bayshore Freeway in Oakland.

The Department of Public Works will continue its activities to determine the essential facts with relation to both crossings. When these factors are determined, and before deciding the priority of construction, the California Toll Bridge Authority will hold public hearings at which interested persons and public agencies will be invited to testify.

Road Builders Discuss Current Highway Problems

HIGHWAY CONSTRUCTION in 1948, pending highway legislation, the effect of the Marshall Plan on the road-building industry, and many subjects pertaining to postwar highway and airport development, were discussed at the annual meeting of the American Road Builders Association, held recently in Washington, D.C.

Among those addressing the three-day conference were Maj. Gen. Philip B. Fleming, M. ASCE, Federal Works Administrator; Thomas H. MacDonald, Hon. M. ASCE, Commissioner, Public Roads Administration; and Charles M. Upham, M. ASCE, engineer-director, American Road Builders Association.

Other ASCE members who gave talks on various phases of highway and airport construction at the technical sessions were: Robert B. Brooks, Claude L. McKesson, Leslie Williams, Raleigh W. Gamble, Brig. Gen. Gordon R. Young, Miles D. Catton, Frank A. Nikirk, E. C. Crites, John B. Ecker, Harold F. Clemmer, John Nolen, Jr., Fred W. Tuemmler, B. E. Beavin, and Ray Cavendish. Dean S. S. Steinberg, of the University of Maryland, presided at a meeting of the Planning Division.

A meeting of the officers and executive committee of the National Association of State Aviation Officials was held in conjunction with a meeting of the Airport Division, with Maj. Gen. Julian L. Schley, M. ASCE, presiding.

Steels and Welds Are Tested in High-Speed "White Pit"

HIGH-SPEED ROTATION of steel disks inclosed in an armored "whirl pit" is now being used to test steels and welds at extreme temperatures while providing biaxial stress in the test piece all the way to fracture. Basic research on this and other engineering problems is now in progress at the Massachusetts Institute of Technology with funds allocated by the Engineering Foundation. Results will be particularly useful to bridge engineers, shipbuilders, Army and Navy engineers and others interested in the use of steel at extremely low winter temperatures.

In whirl-pit tests, disks, 26-in. in diameter and up to 8 in. thick, are suspended from a flexible steel drive shaft and rotated up to 35,000 rpm in a 30-in. vacuum which prevents heat generation and permits stoppage of rotation at any moment by admission of air.

Composed of three sheets of Class B heavy armor plate, the whirl pit, 40 in. in diameter and 9 ft deep, is lined with lead pigs to preserve the disks for observation and measurement after fracture. As the disk rotates at high speed, the material actually flows toward the edges and thickens the disks at the perimeter. Future tests will provide interesting information on plastic flow and strains. For welding tests a small central disk is welded within the outer disk.

Washington Makes Plans to End Congested Areas

PREPARATION OF A MASTER PLAN for future development of the national capital is now in progress under the Urban Redevelopment Act of 1946, implemented in 1947 by a federal grant of $75,000. Under terms of the act the National Capital Park and Planning Commission, created by Congress in 1926, is authorized to have prepared a comprehensive master development plan as the basis for a future $20,000,000 improvement scheme to rid the city of Washington of its blighted sections in congested downtown areas. Under the act such a plan must be drawn and approved before any specific projects may be undertaken.

Toward this end the commission has selected Harland Bartholomew, M. ASCE, city planning expert of St. Louis, Mo., to prepare a plan which will embody much of the groundwork already laid in studies made since publication of the commission's last annual report, issued 14 years ago. Mr. Bartholomew was consultant to the District Commissioners in preparing the zoning map under the act of 1920 and has acted in an advisory capacity to the Planning Commission since its inception in 19

Waterways Experiment Station Needs Qualified Engineers

QUALIFIED hydraulic, soil mechanics, mechanical, electrical and concrete research engineers to assist in the accomplishment of a greatly expanded research and investigational program are needed immediately by the Waterways Experiment Station, Vicksburg, Miss., according to its director, Lt. Col. R. D. King.

Work in the hydraulics laboratory of the Experiment Station is devoted to practical problems in river and harbor and flood control engineering. Extensive experimentation is conducted on the design of hydraulic structures, such as spillways and stilling basins of major dams, and on works required for maintenance of depths or alignment of navigable channels.

The soil mechanics laboratory is concerned with routine testing to determine the strength and behavior of soils under different conditions which may be imposed and is engaged in original research and the development of soil-testing methods, equipment and techniques. A special branch of the soil mechanics laboratory is engaged in the design of flexible pavements for airports.

The concrete research laboratory is engaged in conducting all major research activities required by the Corps of Engineers pertaining to the basic improvement of concrete structures to be built by the Corps of Engineers.

A fourth technical division at the Experiment Station, the Research Center, serves as a technical information center for the Corps of Engineers and is responsible for reports and publications on research investigations.

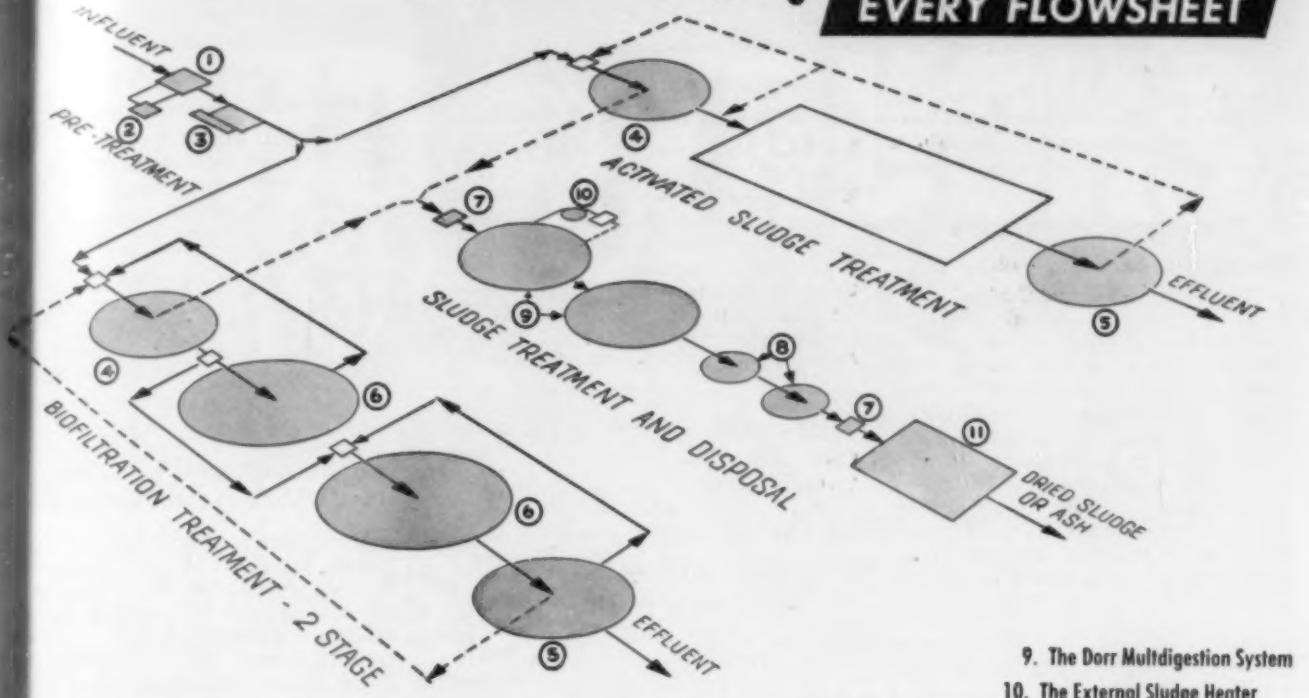
Colonel King states that the Experiment Station offers exceptionally attractive possibilities to professional personnel with opportunities for rapid advancement. Those interested in the work outlined here can submit Applications for Federal Employment (Form 57, which may be obtained from any local post office) to the Director, Waterways Experiment Station, Corps of Engineers, P.O. Box 631, Vicksburg, Miss.

Chicago Professionals to Have Technical, Scientific Center

CREATION OF a Chicago technical and scientific center for the use of professional persons, students and others interested in the advancement of science has been effected through an agreement between the Western Society of Engineers and the John Crerar Library. The society's action in leasing three floors in the library-owned Taylor Building provides the newly created center with offices, conference rooms and an auditorium seating 300—a total of 9,000 sq ft of floor space. Eventually, other professional groups are expected to participate with the Western Society of Engineers in the program of the center.

in sewage treatment . . .

THERE'S A DORR UNIT *for practically* EVERY STEP IN EVERY FLOWSHEET



Regardless of type of treatment or size of plant, there's a Dorr unit for practically every step in every basic sewage treatment flowsheet. The composite drawing above illustrates the extent to which the completely integrated Dorr line of equipment can be utilized to solve sewage treatment problems.

When you specify Dorr you can specify more than individual units of equipment. You can select and specify from the complete Dorr line, all equipment required for the ideal solution to any given problem. One responsibility . . . backed by 30 years of pioneering in sewage treatment.

● *Write for our four page, two color leaflet on new developments recently introduced to the field.*

For Preliminary Treatment

1. The Dorrco Bar Screen
* The Dorrco Fine Screen
2. The Dorrco Sulzer Disintegrator
3. The Dorr Detritor
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For Primary Treatment

* The Dorrco Flocculator
4. The Dorr Clarifier
or
* The Dorrco Monorake

For Secondary Treatment

5. The Dorr Clarifier
or
* The Dorrco Monorake
6. The Dorrco Distributor

For Sludge Disposal and Treatment

7. The Dorrco Sludge Pump
8. The Dorr Thickener
* The Dorr Digester
9. The Dorr Multdigestion System
10. The External Sludge Heater
11. The C-E Raymond System (sludge drying/incineration)

For Combination Treatment

* The Dorr Duo-Clarifier (primary and secondary clarification)
* The Dorrco Duo-Filter (primary and secondary filtration)
* The Dorrco Clariflocculator (flocculation and clarification)
* The Dorr Clarigester (clarification and digestion)
* The Currie Claraetor (aeration and clarification)
* The Dorrco Vacuator (for grit, scum and solids removal)

*Alternative or combination units not shown on composite drawing.

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RESEARCH ENGINEERING EQUIPMENT

Western Construction Projects Announced by Bureau of Reclamation

LARGE CONSTRUCTION projects in Western states are listed in the Bureau of Reclamation's *Advance Construction Bulletin* for January 2 as "Bid Calls Expected This Month." These bid calls are "for information only and subject to revision," the *Bulletin* states. The data given will, however, provide an indication as to the nature, size and location of proposed reclamation projects.

MISCELLANEOUS CONSTRUCTION

Columbia Basin Project, Washington

Location: Vicinity of Grand Coulee Dam.
Work: Production of concrete aggregate; completion of right powerplant control building, right powerplant control cable tunnel, and right powerplant parking area; placing of miscellaneous architectural finishes in powerhouse, service and control bays of right powerplant; construction of right switchyard; construction of transformer circuits and tie circuits between right and left switchyards; construction of transformer platform for substation for maintenance of spillway bucket.

Excavation (all classes)	220,000 cu yd
Preparation of aggregate	280,000 tons
Furnishing reinforcing bars	700,000 lb
Placing reinforcing bars	2,500,000 lb
Concrete	28,000 cu yd
Erection of steel structures for transformer and tie circuits	670,000 lb
Furnishing and installing steel and wrought-iron pipe	62,500 lb
Furnishing and installing cast-iron bell-and-spigot pipe	175,000 lb
Installation of electrical conduits	49,000 lin ft
Erection of steel structures for right switchyard	1,300,000 lb

Time Allowed for Completion: 500 days

CANAL

Central Valley Project, California

Location: Near Visalia, Calif.
Work: Construction of earthwork, lining, and structures of approximately 14.5 miles of Friant-Kern canal.

Excavation	2,803,000 cu yd
Concrete	97,000 cu yd

Time Allowed for Completion: 700 days

TUNNEL AND CANAL

Riverton Project, Wyoming

Location: At confluence of the Wind and Big Horn rivers near Pavillion, Wyo.
Work: Construction of Muddy Ridge Tunnel, approximately 2,870 ft long; about 2,000 ft of Wyoming Canal and extensions; about 2,000 ft of lateral.

Excavation	113,900 cu yd
Concrete	3,400 cu yd
Furnishing and placing steel tunnel supports	190,000 lb
Furnishing and placing reinforcement steel	188,000 lb
Timber lagging	113 Mb. m

Time Allowed for Completion: 600 days

WASTEWAYS

All-American Canal Project, California

Location: Vicinity of Indio and Coachella, Calif.
Work: Construction of earthwork and structures, and lining Wasteways 2 and 3 for flood protective works.

Excavation, channels	371,000 cu yd
Excavation, structures	24,600 cu yd
Concrete, channels	9,200 cu yd
Concrete, structures	1,830 cu yd

Time Allowed for Completion: 360 days

PENSTOCKS

Davis Dam Project, Arizona-Nevada

Location: 30 miles west of Kingman, Ariz.
Work: Fabrication of five 22-ft-dia welded, plate steel penstocks.
Time Allowed for Completion: 500 days

CANAL

Central Valley Project, California

Location: Near Tracy, Calif.
Work: Construction of earthwork, lining, and structures for 13.6 miles of Delta-Mendota Canal.

Excavation	6,000,000 cu yd
Concrete	102,700 cu yd
Furnishing and placing reinforcement steel	2,667,000 lb
Furnishing and installing 15- to 30-in.-dia concrete pipe	3,200 lin ft

Time Allowed for Completion: 750 days

PUMPING PLANT

Klamath Project, Oregon-California

Location: Near Merrill, Ore.
Work: Construction of Adams 60-cfs pumping plant with wooden superstructure.

Furnishing and placing reinforcement steel	52,000 lb
Miscellaneous metal work	3,000 lb
Installation of pumping units	18,000 lb
Excavation	3,300 cu yd
Furnishing and placing trashrack structures	9,000 lb

Time Allowed for Completion: 180 days

Admiral Hussey Appointed New ASA Administrative Head

APPOINTMENT of Vice-Admiral George F. Hussey, Jr., U.S.N. (Ret), to succeed P. G. Agnew as administrative head of the American Standards Association has been announced by ASA's Board of Directors. Admiral Hussey, who was wartime chief of the Navy's Bureau of Ordnance, took office January 1, 1948.

Instrument Exhibit Shows 100-Year Progress

PRECISION INSTRUMENT EXHIBIT displays century of progress in evolution of fine surveying and engineering instruments—from 110-year-old hoop-sight compass, explorer's transit dating back to 1867 and 80-year-old builder's level to first modern all-aluminum transit. W. & L. E. Gurley, Troy, N.Y., revive practice observed in early days of company's 102-year history of stimulating family interest in employee's work by staging novel 3-day "See-Dad-Work" tour, extended also to general public. Charles I. Day, Assoc. M. ASCE, president (at left), and staff members examine new Gurley glass reticles. Items of company's products here on view include magnetometer assembly, engineer's transit, level vials and electronic anemometer transmitter.

Brand NEW for '48

FORD Bonus* Built TRUCKS

BUILT STRONGER TO LAST LONGER

New all through!

NEW ENGINES! Brand new Six, two new V-8's... up to 145 h.p.

NEW CABS! Million Dollar Cab with living room comfort!

NEW FRAMES! Tougher, more rugged than ever!

NEW BIG JOBS! Biggest Ford Trucks ever... up to 21,500 lbs. G.V.W.

NEW MODELS! Five new series, more than 115 Ford models!

Listen to the Ford Theater over NBC stations Sunday afternoons 5:00 to 6:00 p.m., E.S.T.

Bonus* Built—THE AMAZING RESULT OF AN ENGINEERING PRINCIPLE THAT ASSURES LONGER TRUCK LIFE... and ONLY Ford Trucks Have It!

The great new Ford Trucks for '48 are revolutionary not only because they are *new all through* but because they are the amazing result of a time-proved truck engineering principle. This principle is Ford Bonus Built construction.

Bonus Built—Extra Strength! Every single one of the great new Ford Trucks for '48 is Bonus Built . . . designed and built with a margin of *extra strength* in every vital part. But that is only *part* of this vital truck building principle...

Bonus Built—Work Reserves! This *extra strength* provides WORK RESERVES that pay off for truck operators in two important, money-saving ways . . .

Bonus Built—Greater Range of Use! These Bonus Built WORK RESERVES give Ford Trucks a *greater range of use* by permitting them to handle loads beyond the normal call of duty! That means that Ford Trucks are *not* limited to doing only one single, one specific job!

Bonus Built—Longer Life! What's more, these same WORK RESERVES allow Ford Trucks to relax on the job . . . to do their jobs easier, with less strain and less wear. Thus, Ford Bonus Built Trucks last *longer* because they are built to work *easier!*

See the great new line of Ford Bonus Built Trucks for '48 now!

***BONUS:** "Something given in addition to what is usual or strictly due."—Webster's Dictionary*

LIFE INSURANCE EXPERTS PROVE . . . FORD TRUCKS LAST UP TO 19.6% LONGER!

steel tunnel supports . 190,000 lb

electronic anemometer transmitter.

Texts of Refresher Courses for State Examinations Available

AIDS TO ENGINEERS in reviewing subjects covered in state examinations for professional licenses have been prepared by various agencies. One such aid recently called to the attention of ASCE Headquarters is a 170-page mimeographed book by August E. Waegemann, Jun. ASCE. The book, entitled *California Civil Engineer Examinations and Solutions*, consists of 15 examinations, given between 1940 and 1947 inclusive together with their solutions. Copies may be purchased at $3.50 each from Mr. Waegemann at 2833 Webster Street, San Francisco 23, Calif. Another book used by engineers in preparation for state professional examinations in California is entitled *Fundamentals of Civil Engineering*. Prepared by John K. Minasian, Jun. ASCE, this sells for $3 and may be obtained from him at 531½ West 48th Street, Los Angeles 37, Calif.

Texts of interest to civil engineers used in refresher courses, given under the auspices of the New York Metropolitan Sections of the ASME and the AIEE, include:

Notes on Hydraulics and Thermodynamics, by John D. Constance, 506 Olympia Avenue Cliffside Park 7, N.J.; $3. (Similar notes on Machine Design and Electrical Fundamentals are in preparation.)

Review of Structural Design, by S. W. Spielvogel, M. ASCE, 15 Old Field Lane, Lake Success, N.Y.; $4.

Structural Planning and Design, by William Glendinning, 5123 Bell Boulevard, Bayside, N.Y.; $3.

Engineering Economics and Practice, by M. J. Steinberg and William Glendinning, 5123 Bell Boulevard, Bayside, N.Y.; $3.

Leaflets giving details of the refresher courses offered jointly by the ASME and the AIEE are issued in the middle of January and August each year. Copies may be obtained from the Headquarters of the ASCE, ASME, or AIEE, 29–33 West 39th Street, New York 18, N.Y. Another refresher course is given under the auspices of the Cooper Union Alumni Association, 313 West 53d Street, New York 19, N.Y. Applications should be filed well in advance for the latter course, as enrolment is limited.

Lowest Traffic Death Rate on Record Is Indicated for 1947

TRAFFIC FATALITIES for the year 1947 are estimated by the National Safety Council at 32,500, a total which is 1,200 less than the figure for 1946 and 7,469 less than the record high of 39,969 fatalities in 1941. Although travel figures are not yet available for the entire year, the Council estimates that mileage in 1947 ran about 10 percent above 1946 and about 12 percent above 1941. This would mean a 1947 fatality rate (deaths per 100 million vehicle miles) of between 8.5 and 9—a record low.

Publications and materials on highway safety and related matters of design, construction and traffic facilitation are listed in a bibliography prepared at the request of the National Committee for Traffic Safety and printed for distribution by the Highway Research Board.

R. Robinson Rowe, M. ASCE

IT'S NOT UNUSUAL during dinner at the Engineers Club for the boys to hold a fork in one hand and a pocket slipstick in the other to prove some pertinent point on the performance of pumps. Mrs. Grundy would have disapproved, but tonite she'd have loosed her tongue in earnest—the boys were tearing and folding their paper napkins and measuring the folds with crackers.

"I've got it!" yelled Joe Kerr. "You have to tear off one-tenth of the napkin, then fold a lower corner to the top edge and the areas

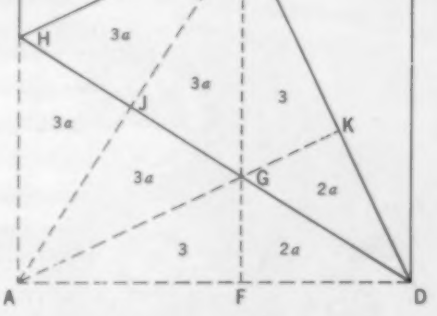


Fig. 1. An engineer folds his napkin

of the 3 triangles will be in the proportion 1:2.5:4. So the largest triangle will have an area of 12."

"Mighty close," conceded Cal Klater, "but it's quicker to use geometry—if you know how. In Fig. 1, rectangle ABCD has been folded into the trapezoid BCDH so that, in area, CDE is a mean between BEH and EDH. The area of BEH is given as 3 and, to avoid fractions, we can let the others be CDE = 3 + 4a and EDH = 3 + 8a. Now draw EF⊥AD, AK thru the intersection G, and rhomb diagonal AE, so that we have 10 triangles which can be expressed in terms of a.

"Obviously CDE is similar to BEH and JDE to JEH, and in each case the scale ratio is DE:EH. Therefore the areas are proportional, that is:

$$3 + 4a : 3 = 3 + 5a : 3a$$

which reduces to

$$4a^2 - 2a = 3$$

$$4a = 1 + \sqrt{13}$$

$$A = 3 + 8a = 5 + 2\sqrt{13} = 12.2111 \text{ in}^2.$$"

"Very efficient, Cal. I was glad to see that you didn't fool around solving for size of the card."

"Well, actually I did, Professor N... My first hunch was that the problem ... set up in integers, as usual, but I found ... dimensions rather complicated."

"But if set up in integers, Cal, it ... have been too easy, as you can see by ... ing a 100×96 card. All integral cards ... be generated by the dimensions $2mn(m^2+n^2)^2$ and $8m^2n^2(m^2-n^2)$, where m and ... are any integers. Since you like integers, ... might be interested in some statistics ... I developed while sending out New Y... cards because I hadn't sent Xmas cards ...

"In Esseyeville alone, the postage ... holiday greeting cards was about $20... On the average, each citizen knew 1 per... of his fellow citizens, 29 percent of the ... zens sent Xmas cards to 10 percent of ... acquaintances and the other 71 per... sent "answer" New Year cards to 7 per... of their acquaintances. If these aver... became exact, how many greeting ca... were exchanged?"

[*Cal Klater was very numerous: A. N... Nutt (the A stands for Anon), Richard ... ney, E. P. Goodrich, Robert E. Phillee, ... Antenuff (Paul Hartman), Kun Pe... (Walter Steinbruch), Anne Otherus... Charles Rathbun), John L. Nagle ... Isidore Knobbe (Joseph S. Lambie). ... missing an early deadline were correct ... tions for the traffic-circle problem from E. ... Goodrich, Wm. P. Murden and Noam ... Wright II (Allyn P. Bursley).*]

Parking Problems Cause Tax and Revenue Losses

CURB PARKING represents, in some ca... a cost to the municipality of $142 per ... per car, according to L. S. Waterbury, ... ASCE, who recently completed a par... survey for the city of Fort Worth, Te... Addressing the Texas Section of the Soci... on "The Parking Problem" as reported ... the November issue of its official organ, ... *Texas Engineer*, Mr. Waterbury pointed ... that while great advances have been ma... in highway development in the past ... years, little improvement has been achie... in terminal traffic accommodation.

In 1940, he said, the number of vehi... almost doubled that of 1920, and the m... age traveled by each vehicle almost doub... over the 1920's. But the street pattern ... most of our cities remained unchang... Consequently, we have severe congest... The development in our cities has been ... vertical scale, with about the same st... pattern. "The seriousness of the situation ... Mr. Waterbury stated, "is apprecia... when it is realized that in many cities ... reduction and loss in taxable evaluation ... the business district has been as much a... to 40 percent.

In Fort Worth, where a 25 percent ... crease in parking facilities can solve ... problem, the survey indicates that off-st... parking can be provided in a three-l... open garage at a cost of $500 per car. ... San Francisco at Union Square, which ... commodates 1,500 cars, the cost is $... per car space.

All-Welded Vertical Lift Span Replaces Barge Bridge

By V. R. Gorham, Vice President
Cleary Bros. Construction Co.
West Palm Beach, Florida

THE old floating barge that carried highway traffic of State Route 71 across the Intracoastal Waterway at White City, Florida, has been replaced by a modern all-welded steel lift bridge constructed by our company.

The new bridge is designed for H-15 loading and is supported on concrete piles and piers. The overall length is 235′.

A total of 98 reinforced-concrete piles, 18″ square x 44′ long, were cast and driven to form the piers under the towers and the two end bents. Driving of pier piles was done from a barge with a Northwest crane fitted out with leads, using a No. 1 Vulcan Steam Hammer. For steel erection, the crane was fitted with a 95′ boom.

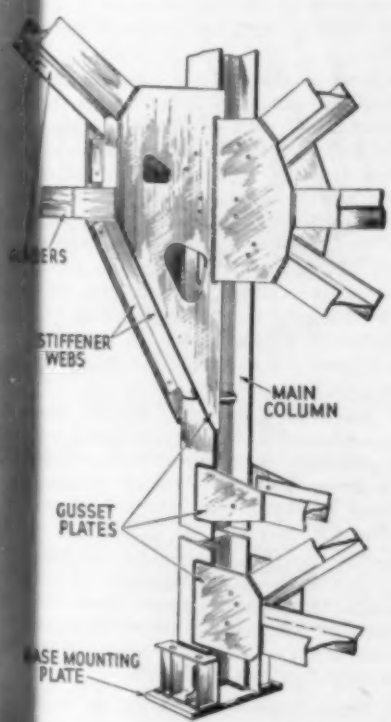


Fig. 1. Construction detail of main column at base foundation showing welded assembly of girders to column.

Fig. 2. Modern all-welded construction lift span bridge.

Pier forms were built of ¾″ sheeting with 2 x 6 studs on 16″ centers, and double 2 x 6 wales on 30″ centers for the average panels.

Steel for the towers and lift span was supplied by the Virginia Bridge Co. The two trusses for the 107′ lift span were already assembled when delivered, and the rest of the span welded together at the job site. Timber piles were driven in a nearby inlet, the span assembled and welded on this false-work, and then floated on two barges to its place in the bridge.

The trusses are 12′ 6″ high and are on 33′ 6″ centers. Near the bottom they are connected by 30″ 116-lb. I beams which are spaced 15′ apart and carry 14″ WF stringers. These stringers in turn support a 5″-thick concrete-filled steel deck grating.

The towers consist chiefly of 12″ WF 25 and 40-lb. beams. At the base each tower is 36′ 9″ wide x 28′ long. At the top the width is the same, but the slope on the back members cuts the length down to only 8′.

The weight of the lift span, including flooring and machinery, is 227,870 lbs. Theoretically the counterweights should have weighed half of this, or 113,935 lbs. each. Instead, the counterweights were made to weigh 109,940 lbs. each, with pockets for addition of balance blocks so the most efficient ratio could be worked out in actual tests.

"Fleetweld" electrodes and "Shield-Arc" welders, manufactured by The Lincoln Electric Company were used. The welders were of the engine-driven type with pneumatic tired running gear to provide easy portability.

The construction crew employed on the bridge averaged 23 men, consisting of a crane operator, 2 welders, 5 carpenters, 5 structural steel workers and 10 laborers. Had riveting been used, we would have required about 6 more men.

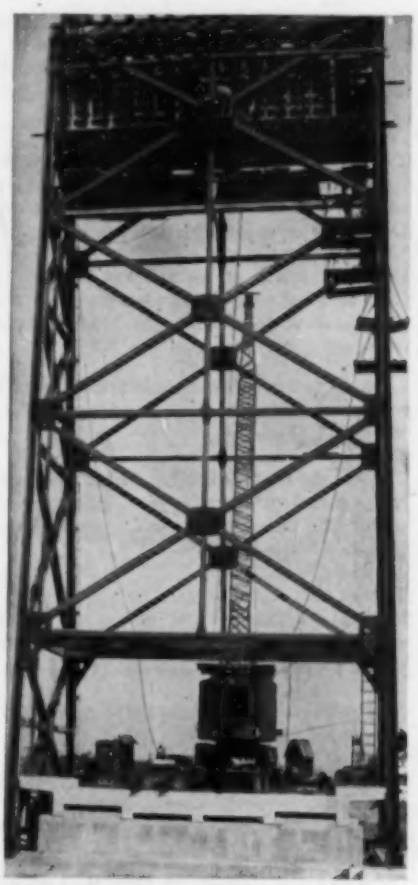


Fig. 3. All-welded steel tower assembled on concrete pier.

Wool Gatherings by WOOLLEY

BASED ON MILES DRIVEN per fatality, 16-year-old drivers as a group have a record more than nine times worse than drivers 45 to 50 years of age.

TVA HAS ENOUGH water to supply power to its customers but not enough to satisfy operators of recreation facilities along its lakes.

THE 1947 WATER YEAR was characterized by excessive volumes of runoff over broad regions of the United States and Canada.

A NATURAL FLOW of one million gallons an hour or 25,000,000 gal per day from one water well is the largest in the United States. It is located in San Antonio, Tex.

THE MORMON TABERNACLE in Salt Lake City has been equipped with a new aluminum roof, consisting of almost 60,000 sq ft of preformed aluminum sheet.

DROUGHT IN GERMANY in the American zone has reduced hydroelectric-plant output to only 8 percent of the consumption in recent months compared to 60 percent a year ago.

THE HIGHEST and lowest points in the United States are in California, 60 miles apart. Mt. Whitney is 14,501 ft high and Death Valley is 300 ft below sea level.

IN 1946, collision, derailment and other train accidents resulted in only one passenger fatality for each 996,000,000 miles traveled.

SEVERE DROUGHT in October 1947 greatly restricted hydroelectric operations in New York and Maine.

TUNNELS CONSTRUCTED in connection with hydroelectric projects are not improvements within the meaning of the Canadian Taxation Act.

THE LAST Colorado Legislature passed laws giving the State Board of Health more power in enforcing standards for safe water supplies.

REGISTRATION OF ENGINEERS now totals nearly 115,000.

WELLS IN LONDON at Chiswick, Fulham and Hammersmith were overflowing a hundred years ago, whereas now the water level is about 250 ft below ground level.

THE OLD COMMON LAW of England is the basis of our present law relating to ownership of city streets.

INDUSTRY IS spending 450 million dollars a year on research now in contrast to the 80 million it averaged during the 1941–1945 period.

New Publications

Wind Waves. A 177-page book, entitled *Wind Waves at Sea, Breakers and Surf*, develops further the Navy Hydrographic Office series of publications on sea, swell and surf conditions, initiated during the war to give the Armed Services a basic knowledge about the oceans. Authors of the book, which is issued as Hydrographic Office Publication No. 602, are Henry B. Bigelow and W. T. Edmondson. Copies are for sale by the Hydrographic Office and the Superintendent of Documents, Washington 25, D.C., at a price of $2.80.

Welding Symbols. To keep pace with the growth of welding, the American Welding Society has issued a 1947 revision of *Standard Welding Symbols*. Representing the ultimate in simplification of presentation and improvement of nomenclature, the revision covers 34 of the processes used in various representative industries. Copies of the new standard, which is priced at 50 cents, may be obtained from the American Welding Society, 33 West 39th Street, New York 18, N.Y.

Waterways Experiment Station. Issuance of three new Waterways Experiment Station bulletins has been announced by the Army Corps of Engineers. These are Bulletin No. 28, which reviews the "Practical Application of Experimental Hydraulics"; Bulletin No. 29, entitled "Certain Considerations in the Design of Flexible Pavements, Bases and Subgrades"; and Bulletin No. 30, which deals with "Air Entrainment in Concrete Design." Copies are available from the Waterways Experiment Station, Vicksburg, Miss., at a cost of $1 for Bulletins 28 and 30, and 75 cents for Bulletin No. 29.

Water Evaporation. Data relating to evaporation from water surfaces in California are presented in Bulletin No. 54 of the Division of Water Resources of the California Department of Public Works. The report, which was prepared by the late Arthur A. Young, Assoc. M. ASCE, summarizes pan records and coefficients developed during the period 1881–1946. Inquiries should be addressed to the California Department of Public Works, Sacramento, Calif.

Highway Research. Continuing its series on Current Road Problems, the Highway Research Board has revised its wartime pamphlet, "Recommended Practice for Treatment of Icy Pavements." Issued as Bulletin 9-R, the current revision takes into account the increasing use of chlorides in abrasives and gives the proper proportions for producing maximum results. The bulletin may be obtained from the Highway Research Board, 2101 Constitution Avenue, Washington 25, D.C.

Topographic Mapping. An index in map form showing the status of topographic mapping in the United States and its possessions has been prepared by the U.S. Geological Survey. The Survey has also published indexes showing the status of aerial photography and aerial mosaics in the United States. These indexes are available on request, without charge, from the Map Information Office, Geological Survey, Washington 25, D.C.

Traffic Congestion. A comprehensive study of local traffic congestion has been issued by the New Jersey State Highway Department under the title, "New Jersey's First Parkway Route 4." Impressively illustrated with photographs and charts, the report represents months of origin-and-destination studies by the State Highway Department in cooperation with the Public Roads Administration. Inquiries should be addressed to the State Highway Department, Trenton, N.J.

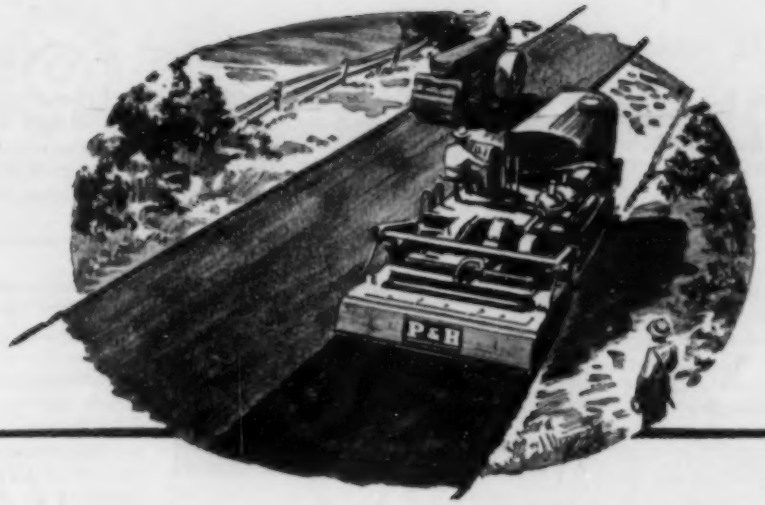
Plywood Standard. Detail grading requirements for exterior and interior types of Douglas fir plywood are covered in a revised standard, CS45-47, of the National Bureau of Standards. Copies are for sale by the Superintendent of Documents, Government Printing Office, Washington 25, D.C., for 5 cents each. A discount of 25 percent will be allowed on orders for 100 or more copies.

Reservoir Sedimentation. Results of an investigation to determine the effects of sedimentation on the plan of operation of the reservoirs proposed by the Corps of Engineers for the Sacramento-San Joaquin Basin are detailed in Special Report No. 1 of the U.S. Soil Conservation Service. Estimates of the effect of sedimentation on the proposed reservoirs were based on surveys of sedimentation in 24 existing reservoirs in the drainage area. The report was prepared by Carl B. Brown, Assoc. M. ASCE, and Eldon M. Thorp. Inquiries should be addressed to the Sedimentation Section, the Soil Conservation Service, Washington, D.C.

Frost Action. To make available to American engineers a worth-while text on frost action with application to highways and railroads, the Technological Institute, Northwestern University has published Gunnar Beskow's *Soil Freezing and Frost Heaving*. J. O. Osterberg, Assoc. M. ASCE, is translator of the text, which represents the culmination of a ten-year period of exhaustive research sponsored by the Swedish government. Copies may be purchased at $3 each from the Technological Institute, Room 302, Northwestern University, Evanston, Ill.

Japanese Research. Several hundred paper-bound journals, representing a major portion of the issues of twelve different Japanese scientific research publications issued during the war, have been received by Carnegie Institute of Technology, Pittsburgh, Pa. The material may be borrowed by scientists and students, upon request to the Carnegie Tech library. About half the material has been translated into English; translation of the remainder must be arranged for by the borrower.

Water Sanitation. To aid sanitary engineers and health officials in evaluating sanitary features of water supplies with which they are concerned, the U.S. Public Health Service has made available a new "Manual of Recommended Water-Sanitation Practice" as Public Health Bulletin No. 296. A limited number of free copies are available for persons engaged in water-works sanitation from Public Health Inquiries Section.



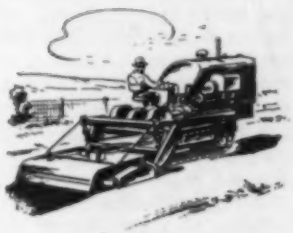
WHAT'S NEW *in Soil Stabilization?*

Developments in soil stabilized roads have come rapidly during the past few years. Scientific control of mixtures with native in-place materials now makes it possible to accurately predetermine load carrying capacities.

New speed and efficiency have also entered the picture with the development of the P & H Single Pass Stabilizer. Working under varying local conditions in widely scattered areas, these machines have proved their ability to fulfill these eight basic requirements of processing soils at a single pass — *with any type of admixture:*

1. **Control processing depth for accurate proportioning**
2. **Pulverize the soil thoroughly**
3. **Blend materials uniformly**
4. **Create a true sub-grade**
5. **Disperse the liquid through the entire volume in measured quantity**
6. **Mix the coated material uniformly**
7. **Lay the completely processed material in a fluffy, even depth, ready for compaction**
8. **Do all these things in one pass — at a good rate of speed.**

One typical example of P & H Single Pass Stabilizer performance is given at left. Highway Departments and Contractors interested in the most recent developments should write us for complete information.



Soil Bituminous Stabilization in Texas.

Two borrow soils, sand and light clay, were combined and mixed with 4% of RO4 (cut back asphalt) to a depth of 6" in a single operation. The P&H Single Pass Stabilizer's average production was 1264 square yards per hour while processing an 18 foot roadway in two nine foot lines — over a mile of roadway per day of 8½ hours.

P&H HARNISCHFEGER CORPORATION

SINGLE PASS STABILIZERS

4651 West National Avenue
Milwaukee 14, Wisconsin

EXCAVATORS • ELECTRIC CRANES • ARC WELDERS • HOISTS • WELDING ELECTRODES • MOTORS

Office of Health Information, U.S. Public Health Service, Washington, D.C. Copies in quantity may be obtained from the Government Printing Office, Washington 25, D.C., at 15 cents each.

Technology in Palestine. Recent technological developments in the United States and Palestine are reviewed in the *Technion Yearbook 1947*. Authors include Arthur H. Compton, Nobel Prize winner in physics; Robert E. Doherty, president of the Carnegie Institute of Technology; Theodor von Karman, M. ASCE, director of the Daniel Guggenheim School of Aeronautics, California Institute of Technology; and Walter C. Lowdermilk, assistant chief, U.S. Soil Conservation Service. Inquiries should be addressed to the American Technion Society, 154 Nassau Street, New York 7, N.Y.

Maps. Maps of the Red River from Fulton, Ark., to the Mississippi River, prepared by the New Orleans District of the Corps of Engineers, are now for sale by the New Orleans District at a price of 50 cents. The series of 17 maps drawn to a scale of 1:62,000, includes Lower Old River, La.

Highway Traffic. Toll facilities and mathematical methods of measuring the influence of bridge tolls on traffic flow are discussed in *Toll Bridge Influence on Highway Traffic Operation*, by M. Earl Campbell. The 112-page volume, originally submitted as a thesis to the Yale University Bureau of Highway Traffic, has been published as Technical Report No. 2 by the Bureau.

Meetings and Conferences

American Concrete Institute. Inspection of the engineering laboratories of the Bureau of Reclamation and exhibits by the construction industry are highlights of the diversified program planned for the annual convention of the American Concrete Institute, to be held at the Shirley-Savoy Hotel, Denver, February 23–26. For details see the January issue of CIVIL ENGINEERING, page 71.

American Society of Mechanical Engineers. Papers on a wide variety of technical subjects have been scheduled for the spring meeting of the American Society of Mechanical Engineers, to be held at the St. Charles Hotel, New Orleans, La., March 1–4.

Associated Equipment Distributors. Present and anticipated problems facing the construction industry will be discussed at the 29th annual meeting of the Associated Equipment Distributors, scheduled for the Edgewater Beach Hotel, Chicago, February 15–19.

Associated General Contractors of America. The Adolphus and Baker hotels in Dallas, Tex., will be headquarters for the 29th annual convention of the Associated General Contractors of America, February 9–12. Requests for reservations should be addressed to Mr. William E. Woodruff, the Associated General Contractors of America, Munsey Building, Washington 4, D.C.

Minnesota Federation of Engineering Societies. The 15 member groups of the Minnesota Federation of Engineering Societies will stage their 26th annual engineering convention and third annual engineering exposition in St. Paul, Minn., February 11–14. Convention headquarters will be the Hotel Lowry, and the exhibits will be held in the Municipal Auditorium. Inquiries should be addressed to Federation Secretary Katherine A. Feucht, 1000 Court ian Building, St. Paul, Minn.

NEW IN Education

HOUSING RESEARCH at work will be the theme of the Third Annual Short Course in Residential Construction for Contractors and Builders to be held February 17 and 18 at the University of Illinois. The course will center around housing research being carried on at the University, including reports on the "industry-engineered house," seven of which have been built by the University. A time-and-motion study of construction techniques is being conducted on six of these houses to provide contractors with ways and means of reducing construction costs. The seventh house is serving as a laboratory for the study of coal handling, heating equipment, storage walls, and kitchen-laundry arrangements. Registrations and requests for information should be sent to the Division of University Extension, Urbana, Ill.

TRAFFIC COURT JUDGES and prosecutors will meet February 9 to 14 on the campus of the University of California at Berkeley in cooperation with the American Bar Association and Northwestern University Traffic Institute. This is the third conference of a series, the first of which was held in June 1947 at New York University. Also scheduled for the University of California is a course of specialized training for traffic police personnel opening at the Berkeley and Los Angeles campuses, respectively, on February 9 and February 23. Police from 11 western states are eligible to attend these courses offered by the university in cooperation with the Traffic Division of the International Association of Chiefs of Police.

TAU BETA PI fellowships for graduate study in engineering, amounting to $1,100 each, are open to all Tau Beta Pi members for the school year 1948–1949. Application forms must be mailed by February 29, 1948. For information write to Paul H. Robbins, Director of Fellowships, 1359 Connecticut Avenue, N.W. Washington 6, D.C.

OHIO STATE UNIVERSITY has established a Department of Welding Engineering, the first of its kind in the nation, according to an announcement by the university's president, Howard L. Bevis. The new department, which is in the College of Engineering, will offer undergraduate work leading to the degree of Bachelor of Welding Engineering and advanced study for graduate engineers.

REORGANIZATION OF the scientific library of the Naval Postgraduate School, Annapolis, Md., has been effected by cataloging and reclassifying the material according to the latest methods, featuring special classification adaptations for Aeronautics, Electronics, Engineering, Radio and Electronics, Nuclear Physics, and using Library of Congress printed cards extensively. The firm which did this reorganization work, Technical Library Consultants, Inc., has prepared a library manual which may be obtained by readers of CIVIL ENGINEERING free on request to its New York City address, 15 Madison Avenue, New York 17, N.Y.

Overproduction of Engineers Not Likely Says Columbia Dean

UNLESS THE PRESENT unreasonably large enrolment in engineering is long continued there is little fear that American schools will overproduce in turning out future engineers. This opinion was expressed by James P. Finch, M. ASCE, dean of Columbia University's School of Engineering, in his annual report to the university. "The country today needs trained engineers more than ever before," Dean Finch stated. "The impetus of war on engineering and industrial development is reflected in the unprecedented long-range demand for technical men."

One result of the war, as observed at Columbia's School of Engineering, has been "a very remarkable shift in student interest to industrial engineering, according to Dean Finch. The department of industrial engineering, although one of the smallest in the school before the war, now claims the largest registration. The Columbia School of Engineering, which is continuing to emphasize graduate and research study, has endeavored to provide this specialized training while insisting on basic science and engineering courses required of all students," he asserted.

Dean Finch charged the profession with failure "to make clear to the public and those interested in furthering research the fact that adequate support for research in engineering science is essential if technology is to maintain its services to mankind." This is of vital importance, he contended, that fundamental research in engineering be continued.

Chicago Blighted Area Gives Way to Modern Campus

ONE OF THE NATION'S most blighted areas is being transformed into one of the most modern centers of technological education and research under the impetus of the $15,000,000 building program of Illinois Institute of Technology. A component of the overall development program is a complete housing plan to make the 100-acre Technology Center campus in Chicago a cohesive study-work-and-live unit. More than 10,000 persons will live, work or study within the area.

Three buildings in the program are

(Vol. p. 127)

ready completed and in use—a metals research building, a wing of the Engineering Research Building, and Alumni Memorial Hall. Now being completed are a chemistry building and a metallurgical and chemical engineering building. Under construction are two four-story student dormitories, part of the Institute's program for housing students, staff and families in permanent apartment, residence, and dormitory dwellings adjacent to the campus. Besides these buildings, 59 additional academic, laboratory, campus and housing structures will be erected over a five-year period.

Pre-Engineering Training in Liberal Arts Colleges Recommended

THAT THE LIBERAL ARTS college should have an important role in engineering education was the theme of an address by Arthur G. Hayden, M. ASCE, delivered at Ripon College's celebration inaugurating its "Second Century Program." On that occasion Mr. Hayden received a citation "in recognition of outstanding ability and distinguished accomplishment in the field of engineering." His experience in the educational field includes membership on the Committee on Juniors of the ASCE Metropolitan Section, membership on the ASCE Committee on Student Chapters, the chairmanship of the Committee on Student Guidance of the ASCE Metropolitan Section, and the chairmanship of the New York Engineers' Committee on Student Guidance (under the auspices of ECPD).

More liberal arts colleges should follow the example of Ripon and make cooperative agreements with engineering colleges, Mr. Hayden stated in his address. Ripon is one of 12 such colleges which have a cooperative agreement with MIT whereby students spend five or six years divided between the two institutions and acquire both an A.B. and an S.B. degree. The mortality rate of such students in the engineering school, Mr. Hayden said, has been reduced to 10 percent or less as compared with the general average of over 60 percent—a convincing demonstration. Excerpts from his address follow:

"A deplorable state of affairs exists in the field of engineering education. A nationwide survey showed that more than 60 percent of those who enter engineering colleges fail to graduate and that about 40 percent of the graduates fall by the wayside in the profession itself. The total mortality is thus about 75 percent. This is a sad loss of the best years of a young man's life.

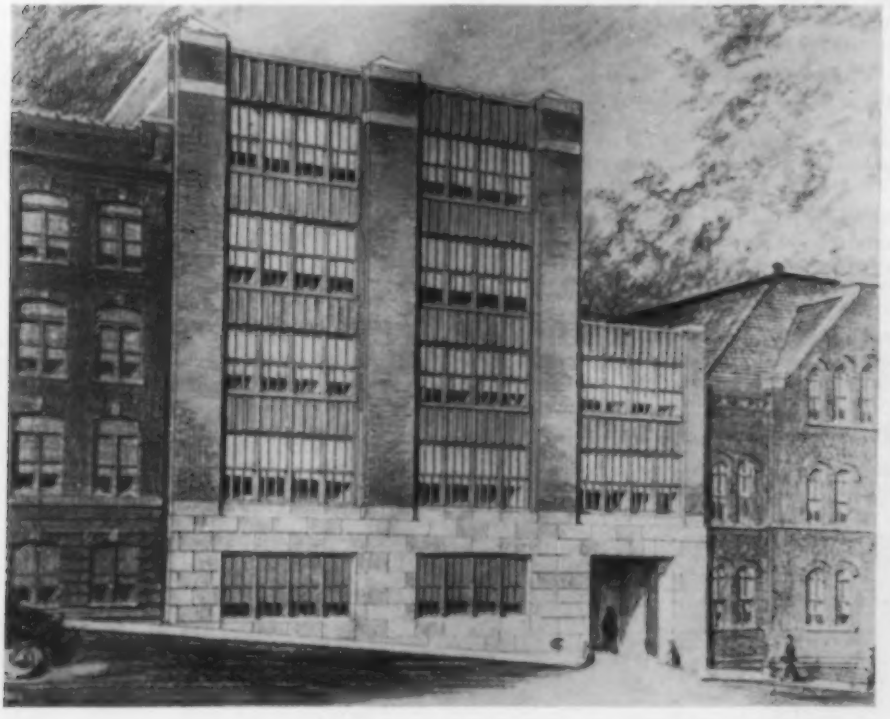
"A fundamental mistake is made in the habit of sending high school graduates directly into engineering colleges without intermediate training. The high school graduate is usually too immature and ill-informed to know for sure what he is best fitted for. In addition he finds himself in an atmosphere that does not stimulate interest in cultural subjects. These are taught better in the liberal arts colleges where they are regarded as of prime importance and not as frills.

"The liberal arts colleges should establish 'pre-engineering' courses to include the basic technical fundamentals underlying an engineering education and selected 'cultural' subjects. No subjects in addition to those usually offered in liberal arts curricula need be established but existing subjects can be grouped so as to constitute formal pre-engineering courses that will have a psychological effect in attracting students. The pre-engineering course should also include orientation lecture courses by engineers who can explain what engineering is, what an engineer does, and what qualities and natural aptitudes are necessary for success in the profession. The average student is woefully ignorant on this subject.

"Orientation will be more effective in college pre-professional courses than in high schools. If the student decides that he does not want to be an engineer, little is lost because his course is useful in a wide field outside of engineering."

Newark College Starts $2,700,000 Building Program

DESIGNED TO HOUSE most modern of engineering laboratory equipment, addition to Newark College of Engineering is placed under construction with award of contracts totaling $500,000. Final laboratory structure (below, left), containing facilities for professional offices, will centralize all phases of college's work for benefit of New Jersey industry. College's $2,700,000 building program, thus initiated, also includes Tower Building (below, right), 20-story structure for future construction to house college offices, classrooms, gymnasium, technical libraries, museum, and professional offices.

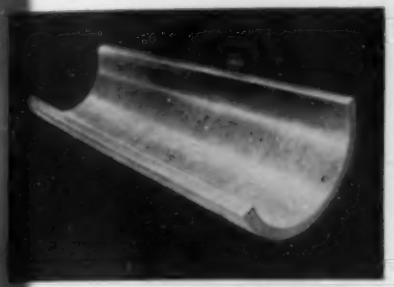


Engineering Facts about

Johns-Manville TRANSITE PRESSURE PIPE

Carrying Capacity

EXAMINATION of the interior wall of Transite* Pressure Pipe will quickly disclose its uniformly smooth surface. This smoothness, imparted during manufacture by forming each length under pressure on a highly polished steel mandrel, accounts for the high flow coefficient of Transite Pressure Pipe—C-140, based on the Williams and Hazen formula.



The unretouched photograph above shows Transite's exceptionally smooth interior surface—imparted by the polished steel mandrel on which the pipe is made.

Moreover, because Transite is made of asbestos and cement, it is inherently and completely immune to tuberculation. This means that the initial high carrying capacity of this pipe remains high in service—a fact which has been confirmed by accurate Pitometer tests.

One important advantage of Transite's maintained high carrying capacity is the assurance of an ample flow of water for both normal and fire-fighting needs in the years to come. Pumping equipment can be operated closer to peak efficiency; pumping costs can be held to a minimum. Taxpayers can receive the benefits of the favorable fire insurance rates which result from a modern, efficient water distribution system of ample capacity.

Accurate Pitometer tests conducted in the field verify Transite's maintained carrying capacity of C-140.

Another advantage—the engineer may design his water system with pipe of minimum diameter, rather than resort to larger pipe than would otherwise be necessary in order to offset the progressive reduction in flow caused by tuberculation. This practice is not necessary when Transite Pressure Pipe is specified.

As indicated by tests, Transite's *maintained* carrying capacity helps provide the abundant fire-flow essential to adequate protection and to favorable fire insurance rates.

And, of course, since tuberculation is not a problem, the costly expense otherwise involved in cleaning and lining of water mains can be eliminated.

A maintained high-carrying capacity is one of many advantages of Transite—the modern asbestos-cement pipe that was engineered to carry water more efficiently and more economically. For further facts, write for Brochure TR-11A. Address Johns-Manville, Box 290, New York 16, New York.

*Transite is a registered Johns-Manville Trade Mark

JOHNS-MANVILLE JM PRODUCTS

NEWS OF Engineers

Frank A. Kittredge, for the past six years superintendent of Yosemite National Park, has been appointed chief engineer of the National Park Service, with headquarters in Washington, D.C. From 1917 to 1927 Mr. Kittredge was senior highway engineer for the U.S. Bureau of Public Roads (now the Public Roads Administration), and since the latter date he has been with the Park Service. Mr. Kittredge's achievements for the Park Service include the establishment of the Kings Canyon National Park and the Olympic National Park and construction of the Going-to-the-Sun Highway crossing Glacier National Park. In his new capacity, he will be assistant chief of development in charge of engineering activities throughout the Park Service.

F. A. Kittredge

Alex Van Praag, Jr., consulting engineer of Decatur, Ill., has been elected president of the National Society of Professional Engineers. ASCE members elected vice-presidents in the organization are **William Ryan,** Boston, Mass.; **Lawrence Peterson,** Milwaukee, Wis.; and **Robert Coltharp,** Austin, Tex.

Nathan L. Smith, who retired early in January as director of the Baltimore, Md., Department of Public Works, has accepted a position as engineering consultant to the city. He has also been offered the post of chief engineer of the Baltimore County Metropolitan District.

James K. Searcy has been transferred from the position of office engineer in the Jackson, Miss., district office of the U.S. Geological Survey to Rolla, Mo., where he will serve in a similar capacity. Mr. Searcy was in the Army during the war, attaining the rank of major in the Coast Artillery Corps.

Alexander Lyle is now superintendent for the George H. Flinn Corp. on subway construction in Philadelphia. He was previously chief engineer for the Carleton Co., Inc., on similar construction work in New York City.

Earl L. Mosley has been appointed to the newly created post of utilities director for Denver, Colo. Mr. Mosley recently resigned as city manager of Colorado Springs, Colo.

Dean G. Edwards and **Guy Kelcey,** New York City consultants under the firm name of Edwards & Kelcey, have opened an engineering office in Newark, N.J.

Edwin A. Fisher, Hon. M. ASCE, and former Society Director, Rochester, N.Y., who celebrated his 100th birthday last July 21, sent to Society Headquarters his regrets that he was unable to attend the Past and Active Officers' Dinner preceding the Annual Meeting. In the communication Mr. Fisher, who reports recovering from an illness that hospitalized him for a month, asked to be remembered to his many friends in attendance at the dinner, and that they be assured he was thinking of them.

John J. Theobald has been promoted from the position of associate professor of civil engineering at the City College of New York to a full professorship.

Evan W. Vaughan is now associate professor of civil engineering at Syracuse University. Until recently he was senior civil engineer in the Water Resources Division of the U.S. Engineer Office at Sacramento, Calif.

John G. Hotchkiss has resigned as structural design engineer for Sanderson & Porter, engineers and constructors of New York City, to join the staff of the American Institute of Steel Construction, Inc., as district engineer for the metropolitan New York area.

Ivan R. Jensen, previously instructor in aeronautical engineering at Iowa State College, has become associate professor of civil engineering at the University of North Dakota.

J. S. Dodds, professor of civil engineering at Iowa State College, received a distinguished service certificate "for his contributions to the field of engineering" at the annual meeting of the National Council of State Boards of Engineering Examiners. Professor Dodds is a past-president of the NCSBEE, and has been a member of the Iowa State Board of Engineering Examiners since 1927.

Carlos Lopez, civil engineer of Quito, Ecuador, and vice-president of the Sociedad de Ingenieros y Arquitectos del Ecuador, headed the official Ecuadorian delegation that assisted in the organization of the Sixth Pan-American Congress of Architects recently held in Lima, Peru. Mr. Lopez served on numerous organizational committees and was invited to give the official address at the opening of the Exposition of Painting and Sculpture.

Carlos Lopez

O. W. Crowley, executive secretary of the central branch of the Associated General Contractors of America, is "cited for service" in a recent article in *Construction Methods*, which outlines his many activities in behalf of contractors in the state of Iowa since he helped organize the Associated General Contractors of America in 1923.

Don Johnstone has recently been named assistant director of Associated Architects-Engineers, and is stationed at their Los Alamos (N.Mex.) office. Former editor of CIVIL ENGINEERING, Mr. Johnstone was recently on the staff of Ohio State University and the Scioto-Sandusky Conservancy District, Columbus, Ohio. During the war he served as a commander in the U.S. Civil Engineer Corps.

H. R. McDonald, of the U.S. Geological Survey, was recently named liaison officer between the Survey and the U.S. Bureau of Reclamation, with headquarters in Denver, Colo. Mr. McDonald was formerly in the Phoenix, Ariz., office of the Survey.

Thorndike Saville, dean of the New York University College of Engineering, has been appointed by Governor Dewey to serve on the eight-member New York State Public Health Council, filling the unexpired term of the late **Henry Neely Ogden,** M. ASCE. The council advises the Commissioner of Health on various public health matters including additions and amendments to the State Sanitary Code. Dean Saville, who has just completed a term as Director of the ASCE, has held his present post at New York University since 1936.

Thorndike Saville

C. L. Wartelle has resigned as city engineer of Seattle, Wash., because of poor health, but will serve for a time as consultant to the city engineering department. An employee of the department since 1[illegible], Mr. Wartelle has been city engineer since 1938.

J. F. Friedkin, engineer for the International Boundary and Water Commission, has been assigned by the U.S. Public Health Service to make an investigation of the Lower Tijuana Sanitation District.

John E. Kiker has severed his connection as district sanitary engineer for the New York State Department of Health at Poughkeepsie, N.Y., to become professor of sanitary engineering at the University of Florida. Other additions to the civil engineering department there include **D. A. Firmage,** formerly on the U.S. Engineer Board at Fort Belvoir, Va., and **George Grantham,** previously instructor in civil engineering at the Illinois Institute of Technology.

Charles K. Bartholomew is now in the Bureau of Bridges and Grade Crossings of the New York State Department of Public Works, Albany, N.Y. Other changes in the department include the promotion of **Eric Norton** from senior claims engineer to associate civil engineer. Mr. Norton has been transferred from Albany to Buffalo.

Col. Mason J. Young has been assigned as division engineer of the South Atlantic Division of the Army Engineer Corps, with Atlanta, Ga. He succeeds **Col. George Gillette,** who recently retired from the Army to accept an appointment as executive director of the North Carolina Ports Authority.

Arthur C. Jenkins has opened a consulting office at 870 Market Street, San Francisco, Calif., where he will specialize in transportation engineering and economics. For the transportation research engineer and examiner for the California Railroad Commission, Mr. Jenkins served as a commander in the Navy during the war.

George S. Armstrong, president of George S. Armstrong & Co., Inc., New York City, has been appointed chairman of the business management engineers division of the Committee for Economic Development.

Harry A. Blake, previously on the engineering staff of the American Bridge Co., Columbus, Ohio, has opened an office in Cincinnati, Ohio. He offers a complete structural design and consulting service on steel and concrete bridges, buildings, foundations, and unusual structures of every description.

Charles H. Wagner, until lately chief of construction in the Nashville District of the U.S. Engineer Office, has been appointed project engineer on the Harlan County Dam, located on the Republican River near Alma, Nebr. The dam will be an integral part of the Pick-Sloan Plan.

Robert E. McLaughlin has resigned as chief engineer for McCloskey & Co., Philadelphia building construction company, to go into private practice as a structural engineer. Prior to this connection with McCloskey & Co., Mr. McLaughlin was structural engineer for the Philadelphia School District.

Don M. Forester, for the past two years project engineer for the U.S. Bureau of Reclamation on the San Luis Valley Project in Colorado, is now construction engineer for the Bureau on the Shadehill Dam project on the Grand River near Lemmon, S.Dak.

Harold A. Wilde, assistant district airport engineer for the Civil Aeronautics Authority at Atlanta, Ga., has been transferred to Jacksonville, Fla., where he will assume the position of district airport engineer.

William H. Kershaw recently retired as assistant general sales manager of the Texas Co., New York City, after 37 years of service with the organization. He was appointed assistant sales manager in 1936 and assumed general administrative duties. For years Mr. Kershaw has supervised the company's advertising activities, particularly in the field of radio.

Alfred E. Johnson, veteran employee in the Arkansas State Highway Commission, has been named chief engineer to fill the vacancy caused by the death of **W. W. Zass,** M. ASCE. Joining the commission 20 years ago, Mr. Johnson has served as office engineer and, for the past six years, as assistant chief engineer.

John C. Seeley, of Ann Arbor, Mich., has been made a member of the Ann Arbor consulting firm of Shoecraft, Drury & McNamee, which has been reorganized under the name of Drury, McNamee & Porter. Mr. Seeley has been on the staff of the firm for the past eleven years. In additon to Mr. Seeley, present active members of the firm are **Walter R. Drury, Robert L. McNamee,** and **Samuel D. Porter,** Members ASCE. **W. C. Hoad** and **E. C. Shoecraft,** Members ASCE, will remain as members of the firm in an inactive status.

Charles Haydock, Philadelphia consultant, has been appointed a member of the Pennsylvania State Registration Board for Professional Engineers by Governor James H. Duff.

Ole P. Erickson, until lately in charge of engineering and operation for the Hendry Corp., Tampa, Fla., has formed the Erickson Engineering Co. in Tampa. Under Mr. Erickson's supervision, many improvements to hydraulic dredges and equipment, particularly rock dredging, have been developed. His new company will specialize in dredge design and special dredging problems.

John B. McMorran was recently appointed Rochester district engineer of the New York State Department of Public Works. Mr. McMorran has been in the state service since 1919, becoming assistant district engineer at Binghamton in 1942. A veteran of both World Wars, he directed construction of air fields and hospitals in the South Pacific during the recent war, attaining the rank of lieutenant colonel.

Howard P. Maxton was recently elected secretary and assistant treasurer of the Raymond Concrete Pile Co., New York City. Prior to joining the Raymond Concrete Pile Company in 1945, Mr. Maxton was in the contracts section of the Navy Bureau of Yards and Docks, Washington, D.C.

Deceased

Murray Chase Ayers (Assoc. M. '17) senior structural engineer for the Los Angeles County Department of Building and Safety, Los Angeles, Calif., died suddenly on November 24. Mr. Ayers, who was 63, spent his early career on the construction of railroads and irrigation works in Hawaii. Later he was with the California Division of Highways, and structural designer and engineer for several Los Angeles consulting firms. He had been in the Los Angeles County Building Department since 1933.

Frank Sawin Bailey (Assoc. M. '27) of North Weymouth, Mass., died on January 21, 1947, though the Society has just heard of his death. He was 74. Mr. Bailey had been with Metcalf & Eddy, Boston; the New England Power Association, Boston; the Procurement Division of the Treasury Department, Washington, D.C.; and the Detroit (Mich.) City Engineer's Office. More recently he was with the Stone & Webster Engineering Corp., Boston.

George Everett Baker (M. '18) city engineer of Long Beach, Calif., died there recently. Mr. Baker, who was 66, was in the engineering service of Long Beach from 1923 until 1929 and from 1939 until his death. From 1929 until his return to city service he was with the Metropolitan Water District of Southern California, serving as engineer in charge of the location of the aqueduct and as resident engineer at Los Angeles. He had been city engineer of Long Beach since 1929 and was director of public service from 1939 until the two offices were separated in 1944.

Kenneth Kevin Bickford (Jun. '38) chief inspector in the Construction Department of the City Housing Authority, Oakland, Calif., died on November 23. He was 34 and an alumnus of the University of Santa Clara, class of 1935. Mr. Bickford was junior bridge engineer and inspector on the construction of the San Francisco–Oakland Bay Bridge, and for several years prior his death had been in the Oakland Housing Authority.

Charles Felix Lovan (M. '39) engineer-contractor of Jacksonville, Fla., was killed just before Christmas in the crash of a private plane near Jacksonville. He was 46. From 1931 to 1937 Mr. Lovan was with the Solvay Process Co., at Hopewell, Va., in charge of field engineering as a foreman in charge of operation of the ammonia plant. Since the latter year he had been a member of the Jacksonville engineering contracting firm, Hillyer & Lovan. Mr. Lovan had just been appointed chairman of the ASCE Construction Division's Committee on Construction Contracts and Specifications and ASCE representative to the Associated General Contractors Committee on Construction Contracts and Specifications. He was a former president of the Florida Section.

Charles Felix Lovan

George Robert Ure Buchanan (Assoc. M. '14) of Havana, Cuba, died recently at the age of 71. A Canadian by birth, Mr. Buchanan spent most of his career in Cuba. He had been in the engineering department of the City of Santiago and, beginning in 1902, was for many years with the Cuba Cruz Construction Co., in charge of railroad and other construction projects.

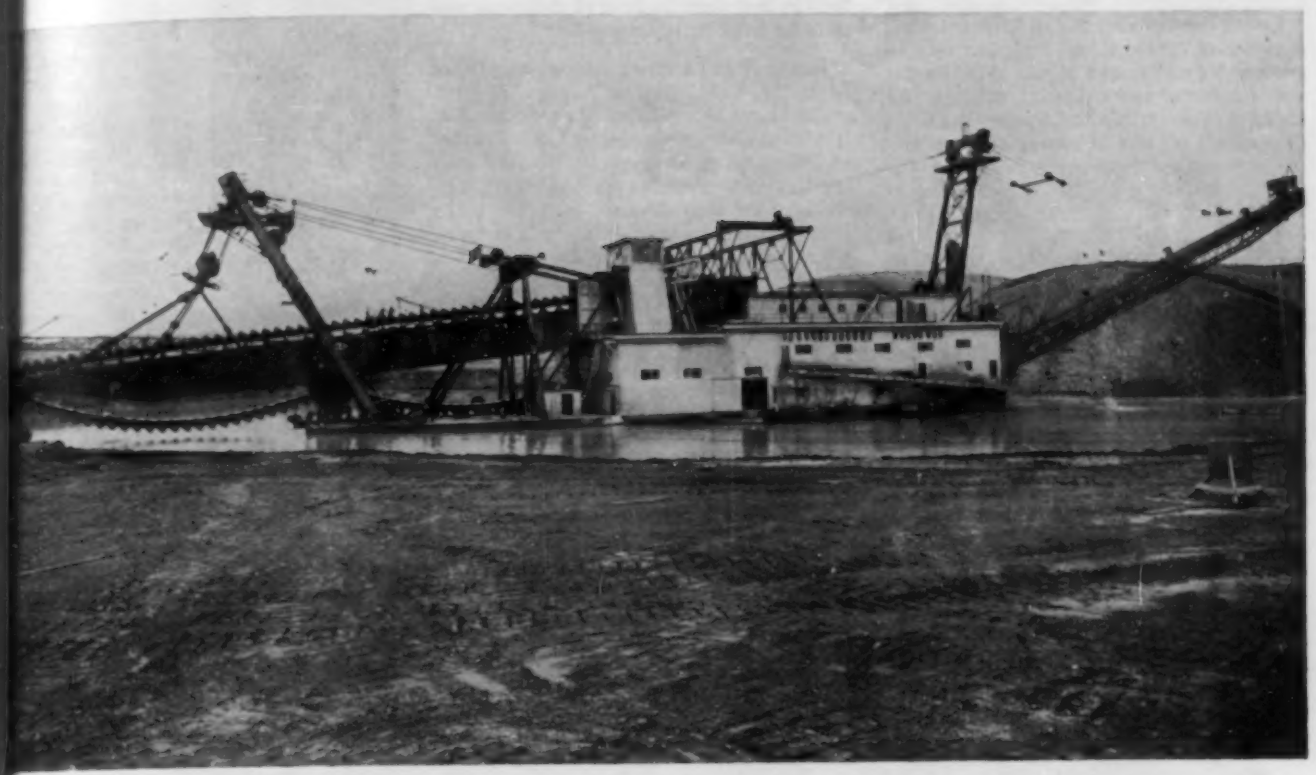
John Fletcher Byxbee (M. '28) consulting engineer for the City of Palo Alto, Calif., died on October 28, at the age of 70. Mr. Byxbee was city engineer of Palo Alto from 1906 until his retirement from active service in 1941. Since the latter date he had been acting in a consulting capacity and as a member of the planning commission. Mr. Byxbee's achievements during his long tenure as city engineer include a planning program of land acquisition and harbor improvement, the public utility system, and grade separations.

Hugh William Crawford (M. '23) consulting engineer for the Phillips Petroleum Co., Bartlesville, Okla., died recently. Mr. Crawford, who was 60, had been with the Phillips Petroleum Co. since 1930. Earlier in his career he was city engineer of Independence, Kans., and Ponca City, Okla., and sales engineer for the Texas Co. During the first World War, he served overseas with the rank of captain.

Wilton Joseph Darrow (M. '13) of Los Angeles, Calif., died in June 1945, according to word just received at Society Headquarters. He was 69. Mr. Darrow had been with the American Bridge Co. and had worked on the structural design of Grand Central Station in New York. For several years he was a member of the New York consulting firm of Balcom & Darrow, and more recently had been concrete designing engineer for the Southwestern Engineering Co., Los Angeles.

Douglass Hewitt Ferry (Assoc. M. '[illegible]) consulting engineer of San Jose, Calif., died at his home there on November 25. He

YUBA BUCKET LINE DREDGES for DEEP DREDGING



Yuba Consolidated Gold Fields Dredge No. 20 operated at Hammonton, California, since 1939. It was designed and built by Yuba Manufacturing Company and has 18 cu. ft. buckets to dig 124 feet below water level. The digging ladder is 216 feet long between centers of lower and upper tumblers. This is the largest and deepest digging placer dredge built in the United States to date for use anywhere in the world.

Placer gravels are dredged successfully with Yuba dredges from a depth of 174 feet below ground level. The problems of deep dredging for gold have been overcome in California where six huge Yuba dredges have dug at depths ranging from 80 to 100 feet below the top of the bank. Two other Yubas dig 112 and 124 feet, respectively, below water level and carry banks, if necessary, that are 30 to 50 feet in height. All of these are operated by Yuba Consolidated Gold Fields and some have been operated in ground which has been dredged once and sometimes twice before. They are reaching deeper deposits and at the same time handling old tailings.

The two largest Yubas in California displace over 4,000 tons each in operating conditions. Such tremendous weights and powerful machinery demand the best in designing skill and operating management. The experience gained in California has been utilized also by Yuba in designing deep digging dredges for tin mining in Malaya. The first large modern dredge in that area was Yuba No. 86 built in 1929. A new standard for performance was established in the tin dredging industry by the work of No. 86. It produced an assigned monthly quota in less than a week and thereby led many operators to reconsider their properties in the light of greater production.

The California gold dredging industry has been a steady producer of new wealth for a period now approaching its fiftieth anniversary. The greater part of placer gold bearing ground is of little value for any use other than mining. Gravel bars, benches and old river channels, made up of material washed down from higher elevations, carry gold which is mined by dredging.

An important part of river dredging in California is done in cooperation with state and federal authorities. Levees built during gold dredging operations confine rivers to deeper channels and help to minimize the overflowing of streams like the Yuba and Feather Rivers. Other areas are protected from flood waters which in the past have reduced good orchard land to silt covered waste deposited there by currents carrying naturally eroded material from upstream sources.

Yuba's experience includes the design and construction of placer mining dredges for special operating conditions. You can consult the Yuba organization concerning any bucket ladder dredging problem with assurance that full and accurate information will be furnished.

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YUBA DREDGES — PROVED DEPENDABILITY ROUND THE WORLD

61. Mr. Ferry spent his early career in mining engineering in the Yukon Territory, and later represented various Canadian mining interests in California, Oregon, and Idaho. At one time he had a consulting practice at Rouge River, Ore.

Pierce Powers Furber (M. '23) structural engineer of Philadelphia, Pa., died on December 19, at the age of 62. Mr. Furber was for some years district manager for C. A. P. Turner, M. ASCE, consulting engineer, and he was in charge of structural design for Stone & Webster, Boston, on improvements made to the U.S. Arsenal at Rock Island, Ill., during World War I. More recently he had been with United Engineers & Constructors, Philadelphia, on a variety of construction assignments.

Howard Allen Glenn (Assoc. M. '39) vice-president of the Standard Bitulithic Co., New York, N.Y., died at his home in West Orange, N. J., on November 26. His age was 53. Mr. Glenn was a road contractor before he joined the Standard Bitulithic Co. ten years ago.

Henri Edward Gruner (M. '25) consulting engineer of Basel, Switzerland, died on November 28, at the age of 74. Widely known as a hydraulics expert, Dr. Gruner had had a consulting practice in Basel since 1913. He designed and directed construction of the hydroelectric power station at Broc and of the Allbruck-Dogern power plant on the Rhine. He had served as consultant to most of the Central European governments and recently advised the Egyptian government on projects for the power development of the Nile. He was one of the founders of the hydraulic laboratory at the Federal Technical University at Zurich, and sponsored research work on snow in his soils mechanics laboratory at Allbruck.

Sam Graham Porter (M.' 11) retired manager of the Department of Natural Resources, Canadian Pacific Railway, Calgary, Alberta, died in Calgary recently. Mr. Porter, who was 72, was born and educated in the United States, going to Canada in 1913 as irrigation expert for the Dominion government. In 1918 he joined the Canadian Pacific Railway as superintendent of operation and maintenance of the company's Lethbridge irrigation system. In 1925 he was appointed assistant manager of the Department of Natural Resources, and from 1927 until his retirement in 1942 was manager of the department. A pioneer in the development of Alberta's irrigation system, Mr. Porter was the first Alberta man to be elected president of the Engineering Institute of Canada.

Sam G. Porter

Stanley Moore Hands (M. '46) testing engineer for the City of Oakland, Calif., died on November 7, at the age of 59. A veteran of the first World War, Mr. Hands had been city engineer of Iowa City, Iowa, and for some years was president and general manager of the River Products Co., Iowa City. Later he served as engineer of special investigations for the materials and research department of the California State Division of Highways on the San Francisco–Oakland Bay Bridge project, and since 1938 he had been engineer of materials and tests for the City of Oakland.

James Norman Irving (Assoc. M. '18) of Riverside, Calif., died on August 11, 1947, at the age of 67. A Canadian by birth, Mr. Irving was educated in the United States and spent his career here. He had been with the U.S. Geological Survey on irrigation investigations in California, and for many years was on the engineering staff of Quinton, Code & Hill, Los Angeles consultants.

Robert Athole MacGregor (M. '10) retired civil engineer of New York City, died at his home there on December 9, at the age of 80. Born in Scotland, Mr. MacGregor came to this country as a young man. He was in the service of the City of New York from 1897 until his retirement in 1935. He had been division engineer in the Office of the Borough President of Manhattan, and for some years prior to his retirement was engineer in charge of maintenance for the Borough of Manhattan.

Jeffrey Burland MacPhail (M. '46) hydraulic engineer for the Shawinigan Water & Power Co., Montreal, Canada, died suddenly at his home there on December 22. He was 53. During the first World War, Mr. MacPhail served overseas with the Royal Canadian Engineers, rising through the ranks from private to major. Joining the Shawinigan Water & Power Co. at the end of the war, he became known throughout Canada as an investigator and designer of hydroelectric plants.

James Rossa McCormick (Assoc M. '20) of Scranton, Pa., died on September 27, at the age of 69. Mr. McCormick had been superintendent of construction and resident engineer in charge of building county roads at Scranton, and he was for a number of years resident engineer for the Philadelphia firm of Ballinger & Perrot on construction projects all over the East.

Benjamin McKeen (M. '95) retired vice-president of the Pennsylvania Railroad, St. Louis, Mo., died at his home in that city on December 16. Mr. McKeen, who was 83, had a long career in railroad engineering, beginning as a draftsman for the Vandalia Railroad in 1885. Later he became general manager of the Pennsylvania Railroad, with headquarters in Pittsburgh, and in 1920 was transferred to St. Louis as vice-president in charge of the Western lines of the railroad. He retired in 1934.

James Warren Pearl (M. '89) of Chicago, Ill., died recently at the age of 90. As chief engineer for various bridge-building companies, Mr. Pearl was in charge of the design and construction of many highway and railroad bridges, including the three-hinged wrought-iron arch over the Salmon River at Pulaski, N.Y. He built the first reinforced concrete arch in America in 1892, and designed the river section of the La Salle Street Tunnel, Chicago, in 1910. Author of many technical articles, Mr. Pearl spent his later years on research on improved sedimentation processes.

William Walter Zass (M. '27) chief engineer for the Arkansas State Highway Department for the past 15 years, died suddenly at his home in Little Rock, Ark., December 12. Mr. Zass, who was [illegible] had been with the State Highway Department since [illegible] and had served as chief engineer since 1932. A veteran of both World Wars, Mr. Zass served in the Engineer Corps during the recent war, on the Pan American Highway Project and with the Persian Gulf Command on the construction of military roads in Iran. Upon his discharge from the Army with the rank of colonel, he returned to his position with the highway department. Long prominent in the Mid-South Section of the Society, Mr. Zass served as president in 1940.

W. W. Zass

Harry Matthew Steward (M. '18) former superintendent of maintenance for the Boston Elevated Railway, died in Medford, Mass., on January 3. His age was 75. Mr. Steward became connected with the Boston Elevated Railway in 1903, and served as superintendent of maintenance from [illegible] until his retirement last April. For 11 years prior to 1903 he was in the engineering department of the Boston & Maine Railroad.

Charles Arthur Strong (M. '30) president of Strong & Macdonald, Inc., Tacoma, Wash, died on December 13. Mr. Strong, who was 64, was superintendent of the Yukon Gold Co. from 1908 to 1912 and general superintendent of the Tacoma Dredging Co. from 1912 to 1919. Since 1921 he had been president of the Tacoma consulting firm of Strong & Macdonald.

William Mellor Sutcliffe (Assoc. M. '[illegible]) engineer for Bay Village, Ohio, died in a hospital in Cleveland on December 9. Mr. Sutcliffe, who was 44, had been engineer of Bay Village for the past 16 years. He was recently given an "outstanding citizen award" by the Bay Village Men's Club, which cited him as "a valued consultant in many branches of the village's administration."

Harry Ramon Trevor (Assoc. M. '[illegible]) of San Francisco, Calif., was drowned in the Pacific on May 3, 1947, in an attempt to rescue two boys from the surf, according to an announcement just received at Society Headquarters. His age was 63. A native of England, Mr. Trevor spent his early career in railroad location engineering around Seattle, Wash. Beginning in 1934, he was with the San Francisco Engineering Department for a number of years.

Sanders Van Auken (Assoc. M. '[illegible]) of Oakland, Calif., died recently at the age of 69. A specialist in the design of ship facilities and cargo-handling gear, Mr. Van Auken had been with the Newport News Shipbuilding & Dry Dock Co., the Seattle Construction and Dry Dock Co., the U.S. Navy Yard at Bremerton, Wash., and the Mare Island Navy Yard. More recently he was with the New York Shipbuilding Co., Camden, N. J., and naval architect for the Transport Command, Fort Mason, Calif.

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ADAPTABLE to the operating of many kinds of auxiliary equipment, "Caterpillar" Diesel Tractors keep finding more and more jobs to do—*better, quicker, cheaper.*

With two such valiant helping hands ("Caterpillar" matched Bulldozer and mounted Hystaway dragline crane), the D7 in these California scenes makes gravel digging and truck loading so easy that little experience is required to man the controls. In fact, the operator on this job had never handled any type of shovel or dragline before the day these photographs were taken. The rig is also used for removing overburden.

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Grouted Gravel Fill and Precast Slabs for Barker Dam

(*Continued from page 31*)

On the basis of data recorded, it is concluded that the form pressures computed from strain-meter observations were fairly representative of actual form pressures as produced by aggregate, water, and grout. It is further concluded that form pressures produced by grout in a mass of aggregate under conditions such as existed at Barker Dam are small in amount regardless of the rate of grouting—which, during the latter part of the work at Barker, was sufficient to increase the grout level about 30 ft a day.

When it is considered that under the low-temperature conditions at Barker the grout remained a plastic material for a period of not less than 24 hours and therefore might by itself be expected to create full liquid pressure for this period of time, it appears that the laws governing lateral pressures of freshly grouted aggregate masses are at variance with those which apply to the grout alone.

Temperatures of Prepakt Concrete

During the period of grouting, the temperature of the water in the reservoir was about 43 deg F. Except near the top of the dam and above the level of the water in the reservoir, the recorded temperature of the water in the Prepakt aggregate above the grouting zone was substantially the same as that of the water in the reservoir.

As the grout level rose there was a tendency toward gradual increase in the temperature of the water and grout at the contact surface until, at the location of Meter 17, about 106 ft above base of dam, its temperature was 13 deg F higher than that of the water above. At this level the layer of warmer water above the grout was found to be about 2 ft deep. Above this layer the temperature of the water in the aggregate mass was the same as that of the water in the reservoir.

For the grouting operation above the level of Meter 17, cold water from the reservoir was pumped down into the aggregate mass through inspection pipes, with points of discharge 5 ft above the grout level. This procedure reduced the temperature of the water at and near the grout contact surface.

The average temperature of the grout as it was pumped through the supply line was 57 deg F. The initial temperature of the grout immediately after intrusion into the aggregate mass varied from 46 deg F near the bottom of the addition, to 56 deg F at the location of Meter 17. Had cooling water been supplied so as to replace the layer of warm water which gradually increased in temperature just above the grout contact surface—as provided by the specifications and as was done above the level of Meter 17—it seems evident that the initial temperature of the Prepakt concrete could have been maintained within 5 deg F of that of the water in the reservoir throughout the complete height of the addition.

As the cement hydrated, the temperatures in the Prepakt concrete increased to a maximum which, for the thick section of the addition usually occurred about four days after grouting, and for the thin section about two days after grouting. The maximum temperature rise due to the hydration of the cement was about 18 deg F in the thick section and about 9 deg F in the thin section.

For the thick section, the average maximum temperature was about 63 deg F, and temperatures after reaching the maximum declined at the rate of about 1 deg F a day.

Three weeks after grouting, the temperatures of the mass had declined to an average of about 50 deg F. Since, under the low temperature conditions of hardening, the Prepakt concrete was of low strength at this age, and plastic flow could readily take place under very low tensile stresses, it may be presumed that during the later stages of hardening all portions of the addition below the level of the water in the reservoir were substantially free of thermal stress.

Conclusions Gained from Experience

In light of the experience gained at Barker, some of the practices there employed would be modified on future work of like character. On a large job it is believed that economies could be effected by using precast slabs of much larger size. With heavy equipment, slabs of perhaps four times the area could be handled without difficulty; and they could be placed in position at about the same rate as the smaller slabs. The total length of joints between slabs would of course be correspondingly reduced, and the cost of slab placement and joint taping and grouting would become a comparatively small item.

The quality of the work at Barker is considered excellent. It is believed that the objectives of the rehabilitation program have been completely realized in that a structure has been produced which for all practical purposes is the equivalent of a new dam, the useful life of which should be long.

With some modifications, the methods employed at Barker—using high-strength weather-resistant precast slabs for the upstream and downstream faces and Prepakt concrete of low cement content for the interior of the mass—hold promise for the construction of new dams.

Court Denies Recovery of Increased Dredging Cost

(*Continued from page 39*)

as to the character of the work but despite this the Court decided in favor of the contractor. During the hearing of this case it was testified that the data given pointed plainly, when read by an informed person, to the possibility of rock on the site. The Court commented on this testimony as follows: "We think this was wisdom after the event. It is charitable to conclude, and we do conclude without resorting to charity, that the persons who prepared the drawing and notes for defendant did not anticipate rock excavation. If we are wrong about this, and these persons did read the notes as indicating rock, they set a trap for the bidders and caught plaintiff."

An Example of Protection for Contractor

Some twenty years ago the Bureau of Yards and Docks of the Navy Department became aware that "Article 4" was not accomplishing its presumed purpose—that of providing for equitable adjustments when subsurface conditions occurred which could not reasonably have been anticipated from the information furnished bidders. The Bureau therefore decided that public policy as well as the self-respect of the engineering profession made it desirable for contracting agencies to assume a part of the responsibility for subsurface conditions which were not indicated by the information available to bidders. The Bureau thereupon began, and has since continued, the policy of inserting the following paragraph in its specifications for work involving excavation:

"*Elevations and Obstructions.* Bids shall be based on the following: (*a*) that the surface elevations are as indicated; (*b*) that rock will not be encountered (or, that rock will be encountered as indicated); and, (*c*) that no pipes or other artificial obstructions, except those indicated, will be encountered. In case the actual conditions differ from those

stated or shown an adjustment in the contract price will be made."

In work which includes piling the Bureau has also, where practicable, specified the lengths of the piles on which bids are to be based with a provision for an adjustment in price for variations from such lengths.

Whether or not this policy has resulted in a direct saving of money can only be conjectured. It certainly has impressed contractors with its fairness and has reduced the probability of inexperienced or reckless concerns' underbidding their more cautious competitors by "taking a chance" which might result in delay, poor work, and litigation.

Subsurface Exploration Prior to Airport Expansion

(*Continued from page 46*)
subsurface strata. A 60-ft casing was left in place for use as a benchmark in these observations.

Area Brought to Uniform Grade

The fill was made by end-dumping to raise ditches and low areas and bring the site to fairly uniform grade. Then the remainder of the fill was placed in increments of 1 ft in loose thickness over the entire area and each 1-ft layer was compacted by six passes of a D-8 Caterpillar tractor or equivalent. Under paved areas, distribution of the wheel loads to be expected required a minimum of 6 ft of selected fill material, consisting of sand and gravel at natural moisture content containing a maximum of 10 percent fines.

As a further precaution against concentrated loads, all side slopes were limited to a grade of 10 to 1. Temporary drainage in the terminal area for the first stage of construction, to be replaced later by a permanent system, consisted of open channels and culverts emptying into existing drainage channels.

This method of constructing the fill makes it probable that the major portion of settlement and consolidation will take place within six months after completion of the overload fill. Some settlement thereafter is expected, but the rate will be considerably reduced and it should be uniform enough not to damage materially any pavement placed on the fill Therefore it is estimated that after a settlement period of nine months, that part of the overload fill that remains above the subgrade may be removed and pavement constructed.

Engineering Administration of Marshall Plan Urged in Address

(*Continued from page 25*)
tions as well as the national welfare by lending some of their engineers and production experts to the administrators of the European Recovery Program for duty abroad. I would suggest that a plan be worked out whereby the private organizations would continue to pay the salaries of their engineers, with the government perhaps supplementing their income and certainly bearing their expenses abroad.

"It is my conviction that engineers can walk firmly in where politicians fear to tread. I believe that is particularly true of the job of getting Europe's factories back to production. I believe that a capable corps of American engineers working with the engineers of the various nations of Europe could do more than any other group of men to insure that the funds and goods granted under the Marshall Plan are not wasted. I believe th the cost to government of supporti these engineers abroad would be paid a hundredfold by the savings increased efficiencies they wo normally achieve. Their month work reports would tell us more th an army of political supervisors.

"The engineers who go abroad w be giving practical substance to of the major themes of the industri revolution. That theme is that wh large regions of the earth or import segments of the population a equipped to produce more efficient the result is not a falling off but a increase of trade for all. You kn perhaps better than any other gro that this technological civilization ours is inherently dynamic and e panding.

"American industry will do itse and the nation a good turn by doing in its power to restore the well-bei of nations which have long been o best customers and are still our be friends."

JACOB INTEGRAPH INSTRUCTIONS AND TYPICAL PROBLEMS. By B. C. Jacob, 205 North Mountain St., Bay City, Mich.; photo offset by Polygraphic Co. of America, New York, 1947. 126 pp., diagrs. charts, tables, 8¼×6 in., paper, apply to author. The Jacob Integraph is a small transparent triangle having ruled lines and small perforated holes so placed as to make it possible to perform graphically a variety of arithmetical and analytical computations. It may be used with an ordinary T-square or triangle or as an attachment on a universal drafting machine. The accompanying instruction book gives a detailed explanation: first, of the simple fundamental operations; and then, of more complex problems in mechanics and engineering, including a variety of practical applications such as determining bending moments and deflections in beams and shafts, impact or collision values, forces and accelerations, volumes of tanks, etc.

SOIL MECHANICS, ITS PRINCIPLES AND STRUCTURAL APPLICATIONS. By D. P. Krynine. 2 ed. McGraw-Hill Book Co., New York and London, 1947. 511 pp., illus., diagrs., charts, tables, 9×5½ in., cloth, $5.50. Presents the principles used in the design, construction and maintenance of foundations of structures, and of structures made of earth material. The engineering applications of these principles are discussed, field and laboratory soil investigations are described, and the settlement of structures, its causes, prevention, and damage are considered. This revised edition brings both the material and the bibliography up to date and includes new sections on highway and runway subgrade.

TABLES OF SPHERICAL BESSEL FUNCTION, PREPARED BY THE MATHEMATICAL TABLES PROJECT, National Bureau of Standards, Vol. II. Columbia University Press, New York, 1947. 328 pp., tables, 10¾×7¾ in., cloth, $7.50. The major part of the present volume is devoted to tables of the spherical Bessel functions $\sqrt{\pi/2x}\,J_n(x)$, $n=\frac{1}{2}$ ranging from $\frac{29}{2}$ to $\frac{61}{2}$ with from 7 to significant figures. This set of tables complements those previously published for n ranging from $\frac{1}{2}$ to $\frac{21}{2}$. A discussion of the properties of these functions and the computation methods used also appeared in the previous volume, which both volumes contain interpolation methods and notes on their respective tables.

TECHNOLOGY OF INDUSTRIAL FIRE AND EXPLOSION HAZARDS. 2 vols. By R. C. Smart. Chapman & Hall, Ltd., London, 1947. Illus., diagrs., charts, tables, 8¾×5½ in., cloth, Vol. I, pp.; Vol. 2, 184 pp., 16s each vol. The two coverage of these two volumes should make them of interest in a wide field of industrial and insurance work. Fire wastage and research are dealt with in Vol. I, as well as the thermal properties of materials and fire risks with agricultural products, coal, industrial fuels, and gas. Hazards with light alloys, light alloy dust explosions, and explosive dusts produced in industry are considered. New materials, techniques and processes are discussed in Vol. II. Dangers due to toxic gases and the use of self-contained breathing apparatus are examined, while electrical and explosions, due to static electricity and lightning are given close attention. Examples of actual fires and explosions are given throughout the book.

THEORY AND DESIGN OF CYLINDRICAL SHELL STRUCTURES (Modern Building Techniques Bulletin No. 1). By R. S. Jenkins. The Ove Arup Group of Consulting Engineers, Colquhoun House, London, W.1, May 1947. 75 pp., diagrs., tables, 9½×7 in., paper, 21s. In addition to a thorough treatment of the design of reinforced concrete cylindrical shell structures, this publication demonstrates the use of matrix calculus in development in the analytical methods for structures in general. The theoretical treatment is based on Jenkins' equation which enables the designer to deal with unevenly distributed pressures and temperature changes, thus allowing for actual calculations of moments, etc. formerly dealt with arbitrarily. This is the first of a series of bulletins intended to further the exchange of information concerning the science of building.

WATERBURY'S VEST-POCKET HANDBOOK OF ENGINEERING, 4 ed., revised by H. W. Reddick and others. John Wiley & Sons, New York; Chapman & Hall, Ltd., London, 1947. 300 pp., diagrs., tables, 5½×3 in., fabrikoid, $2. This practical pocketbook provides mathematical engineering data under the headings of algebra, trigonometry, mensuration, analytic geometry, differential and integral calculus, theoretical mechanics, mechanics of materials, fluid mechanics, heat engineering, and electrical engineering. New sections added in this edition on illumination engineering and radio-electronic formulas. Besides the revised tables from the previous edition, the book contains additional ones on the properties of saturated water and steam.

APPLICATIONS FOR ADMISSION OR TRANSFER

February 1, 1948 — Number 2

The Constitution provides that the Board of Direction shall elect or reject all applicants for admission or for transfer. In order to determine justly the eligibility of each candidate, the Board must depend largely upon the membership for information.

Every Member is urged, therefore, to scan carefully the list of candidates published each month in CIVIL ENGINEERING *and to furnish the Board with data which may aid it in determining the eligibility of any applicant.*

It is especially urged that a definite recommendation as to the proper grading be given in each case, inasmuch as the grading must be based upon the opinions of those who know the applicant personally as well as upon the nature and extent of his professional experience. Any facts derogatory to the personal character or professional reputation of an applicant should be promptly communicated to the Board. Communications relating to applicants are considered strictly confidential.

The Board of Direction will not consider the applications herein contained from residents of North America until the expiration of 30 days, and from non-residents of North America until the expiration of 90 days from the date of this list.

MINIMUM REQUIREMENTS FOR ADMISSION

Grade	General Requirement	Age	Length of Active Practice	Responsible Charge of Work
Member	Qualified to design as well as to direct important work	35 years	12 years	5 years
Associate Member	Qualified to direct work	27 years	8 years	1 year
Junior	Qualified for subprofessional work	20 years	4 years	
Affiliate	Qualified by scientific acquirements or practical experience to cooperate with engineers	35 years	12 years	5 years

APPLYING FOR MEMBER

ABRAMOWITZ, DANIEL EMILE (Age 36) Engr., Federal Power Comm., New York City.

BOSCH, HERBERT MICHAEL (Age 40) Chf., Sec. of Environmental Sanitation, Minnesota Dept. of Health, Minneapolis, Minn.

BUECHELER, WILLIAM GOTTLOB (Assoc. M.) (Age 53) Civ. Engr., Reynolds, Smith & Hills, Jacksonville, Fla.

DOUGLAS, JIM (Age 53) Dist. Engr., Texas Highway Dept., Houston, Tex.

EARLE, RALPH (Assoc. M.) (Age 44) Pres. and Treas., Thomas Earle & Sons, Inc., Jenkintown, Pa.

ECKBERG, ADRIAN EMMANUEL (Age 46) Structural and Hydr. Engr., Chas. T. Main, Inc., Boston, Mass.

FLORAS, CHRISTOS LAZARE (Assoc. M.) (Age 42) Prof. of San. Eng. and Acting Director, Athens School of Hygiene, Athens, Greece.

FOSTER, JOHNSON LEON (Age 44) Chf., Bldgs. & Structures Sec., Engr. Office, 3d Army Hdq., Atlanta, Ga.

FREGOSI, ALBERT (Assoc. M.) (Age 39), Chf., Procurement Div., Mil. Govt. Sec., Hq. 8th Army, San Francisco, Calif.

FRUHAUF, BEDRICH (Assoc. M.) (Age 41) Cons. Engr., New York City.

GEBHARD, IRVIN LLOYD (Age 49) Project Mgr., Western Contr. Corp., Modesto, Calif.

HARDING, ROBERT GEORGE (Assoc. M.) (Age 52) Cons. Engr., Salt Lake City, Utah.

HARDY, ABBY WOLVERTON (Assoc. M.) (Age 55) Aerial Photogrammetric Engr., Arkansas Highway Comm., Magnolia, Ark.

HERNANDEZ-GARCIA, LOUIS MARIA (Age 42) Asst. Dist. Engr., Central Uruguay Ry., Montevideo, Uruguay.

HESS, IRVING CHENEY (Assoc. M.) (Age 67) Div. Engr., California Water & Telephone Co., San Diego Bay Div., National City, Calif.

HEWETT, MAURICE WILLIAM (Assoc. M.) (Age 57) Traffic Engr., City of St. Paul, Minn.

HILBORN, HOWARD DAVISON (Age 60) Chf. Engr., Structural Div., Emsco Derrick & Equipment Co., Houston, Tex.

HUNGERFORD, CLARK (Age 48) Pres., St. Louis–San Francisco Ry. Co., St. Louis, Mo.

JONES, DUDLEY HARWOOD (Assoc. M.) (Age 56) Prin. Engr., Geo. G. Toler Eng. Co., Ada, Okla.

KALINSKE, ANTON ADAM (Assoc. M.) (Age 36) Chf. Hydr. Engr., Infilco, Inc., Chicago, Ill.

KINI, SHRINIVAS MADHAV (Age 40) Cons. Civ. Engr., and Proprietor, M/s S. M. Kini & Co., Archts. and Engrs., Bombay, India.

KLEIN, ALEXANDER (Assoc. M.) (Age 45) Senior Engr., Research Engr., Univ. of California Eng. Materials Laboratory, Berkeley, Calif.

LARSON, EDWARD GUSTAF (Assoc. M.) (Age 56) 1946 to 1947 Gen. Supt., F. H. McGraw & Co. of East Indies, New Guinea; no current job listed; Schenectady, N. Y.

MAAHS, ARTHUR JOHN (Age 49) Chf. Engr., Johns-Manville Sales Corp., New York City.

MATTHEWS, ALFRED RAGNER (Age 43) Major, Corps of Engr., Hq. 2d Engr. Constr. Group, Care, P. M., San Francisco, Calif.

MOSCOVITZ, PAUL (Age 40) Asst. Mgr. and Chf. Engr., Palestine Water Co,, Ltd., and Palestine Mortgage & Savings Bank, Ltd., subsidiaries of Palestine Economic Corp. of New York, Tel Aviv, Palestine.

NEFF, THOMAS O'NEIL (Age 38) Asst. Prof., Mech. and Industrial Eng. Dept., Univ. of Florida, Gainesville, Fla.

PENNEL, JOHN WICKLIFFE (Age 47) Civ. Engr. (private practice), Panama City, Fla.

PHENEGER, BURT RASTY (Age 63) Mgr. of Operations, Duluth Dist., American Steel & Wire Co., Duluth, Minn.

PROKOPP, EDWARD JOSEPH (Jun.) (Age 35) Chf. Engr., J. L. Peters Co., Detroit, Mich.

SERVIS, LESTER WILLIAM (Age 42) Member of firm, Servis & Van Doran, Cons. Engrs., Hays, Kans.

SHORT, W. IRWIN (Age 43) Prof., Civ. Eng. Dept., Univ. of Pittsburgh, Pittsburgh, Pa.

WADDINGTON, JOHN CROSSLEY (Assoc. M.) (Age 46) Chf. Engr. and Managing Director, Waddington & Son, Ltd., London, England.

WALLACE, GEORGE CURTIS (Age 41) Engr. in Chg., Div. of Sewers, City and County of Honolulu, Hawaii.

WEISS, BURRAGE A. (Assoc. M.) (Age 44) Asst. Executive Supt., Imperial Irrigation Dist., Imperial, Calif.

WETTER, GIORGIO (Age 44) Designing Engr. (private practice); Associate Director, Montecatini Milano, Milan, Italy.

WILBURN, LYMAN DWIGHT (Assoc. M.) (Age 47) Chf. Engr., Morrison-Knudsen Co., Inc., Boise, Idaho.

WILEY, TARLEY TARSON (Assoc. M.) (Age 39) Asst. City Traffic Engr., Detroit, Mich.

APPLYING FOR ASSOCIATE MEMBER

BADRINATH, SRINIVAS KESAVA (Age 39) Asst. Div. Engr., H.E.H., The Nizam's Well Sinking Sec., Local Self Govt. Dept., Hyderabad State, India.

BANTON, PEMBROKE CLAYTON (Age 31) 1947 BSCE, Iowa State Coll.; previously Civ. Engr., Office Eng. Div., The Panama Canal.

BERRY, RICHARD NATHANIEL (Age 32) Gen. Mgr., Bay State Constrs. & Erectors, Inc., Malden, Mass.

BOGERT, IVAN LATHROP (Age 29) Eng. Designer, Bogert Childs Eng. Association, New York City.

BOOK, JOSEPH EMANUEL (Jun.) (Age 34) Jun. Engr., U.S. Corps of Engrs., Baltimore, Md.

CARMANY, ROBERT MUIR (Age 41) Associate Physical Testing Engr., State Highway Laboratory, Sacramento, Calif.

COLE, CHARLES WHITMORE, JR. (Jun.) (Age 32) Chas. W. Cole & Son, Engrs. and Archts., South Bend, Ind.

COOK, ROBERT PERRY (Age 31) Hydr. Engr., Asst. Chief of Hydraulics and Hydrology Sec., South Pacific Div., Corps of Engrs., Oakland, Calif.

COX, GEORGE WALTER (Jun.) (Age 35) Constr. Engr., Fordyce Gravel Co., San Antonio, Tex.

CRANDELL, HENRY ALTON (Age 54) Commr. of Streets & Sewers, Kansas City, Mo.

CURRY, JOHN JOSEPH (Age 33) Senior San. Engr., Connecticut Water Comm., Milford, Conn.

CURTIS, RUSSELL GREILICK (Age 49) Associate Engr., U.S. Engr. Office, Little Rock Dist., Little Rock, Ark.

DAVIS, GRANT LIVINGSTON (Jun.) Owner, Grant L. Davis, Civ. Engr.; also, City Engr., Dover, N.H.

DAVIS, THENTON LOWELL (Age 43) Chf. Draftsman, Sinclair Refining Co., Southeastern Dist., Atlanta, Ga.

DECAROLIS, FRED (Age 39) Jun. Engr., Chf. Party, Triborough Bridge Authority, New York City.

D'ERRICO, THOMAS RICHARD (Jun.) (Age 3[illegible] Instructor in Mech Eng., Clarkson Coll. Technology, Potsdam, N.Y.

DELK, FLOYD MCLEAN (Age 46) Senior Res. Engr., Houston Urban Expressway, State Highway Dept., Houston, Tex.

DYKTOR, ROBERT GUSTAVE (Jun.) (Age 27) Engr., Supervisor, Marketing Dept., Creole Petroleum Corp., Caracas, Venezuela.

GAIROLA, SHASHI SHEKHRANAND (Age 44) Post-graduate student in Eng., Univ. of Tennessee (on leave from duties as Asst. Prof., Mech. Eng., Hindu Univ., India), Knoxville, Tenn.

GENSEL, LLOYD (Age 50) Superv. Archt., Public Buildings Administration, Atlanta Div., Dunn[illegible] Ga.

GOODALE, ARTHUR WORTHINGTON (Jun.) (Age 4[illegible] Asst. Supt., Frederick Snar Corp., New York City.

HANNON, LUCIUS, JR. (Age 29) Structural Designer, E. M. Freeman & Associates, Shreveport, La.

HINEMAN, HOWARD RAPHAEL (Age 39) Assoc. Engr., being Res. Engr., Div. of Highways, Bridg Dept., Los Angeles, Calif.

HOPKINS, CHARLES DEWITT, JR. (Age 30) Hyd. Water Supply Forecast Unit, Weather Bureau, Portland, Ore.

HOWLAND, JAMES CHASE (Jun.) (Age 31) Member of firm, Cornell, Howland, Hayes & Merryfield, Corvallis, Ore.

IRWIN, JOHN PAULETTE (Jun.) (Age 34) Owner, Jack Irwin, Engr., Ottawa, Kans.

JANECEK, RUDOLPH JOSEPH (Age 32) Field Engr., Lago Oil & Transport Co., Ltd., Aruba, N.W.I.

JARVIS, CLARENCE BEN (Age 27) Asst. to Maj. Graham, Jr., Cons. Engr., Hollywood, Calif.

JOHNSON, ALFRED MASSEY FISHER (Jun.) (Age 2[illegible] Lt.-Col. (CAC), U.S. Army (hospitalized), Chattanooga, Tenn.

LARUE, ROBERTA (Jun.) (Age 34) Hydr. Engr., Corps of Engrs., Los Angeles Dist., Los Angeles, Calif.

LEFFEL, RALPH ERNEST (Age 34) Instructor, Civ. Eng. Dept., Univ. of Colorado, Boulder, Colo.

LEFFERTS, HORACE LEEDOM (Age 33) Structural Designer, E. I. du Pont de Nemours & Co., Wilmington, Del.

LIBUTTI, ARMANDO (Jun.) (Age 35) Bridge Supt., Granite Mill & Granite Mill Canal Bridge, Harrisville, R.I.

LOUIE, SING HON (DAVID LOUIE) (Jun.) (Age 2[illegible] Hydr. Engr., International Eng. Co., Inc., Denver, Colo.

MACOMBER, ROBERT CHARLES (Age 27) Civ. Engr., Macomber, Inc., North Canton, Ohio.

MCCAIN, EDWIN HART (Age 40) Hydr. Engr., TVA, in charge of Hydrographic & Const. Unit, Hydr. Data Div., Alcoa, Tenn.

MCCANN, EUGENE HARRISON (Age 34) Dist. Civ. Engr., Humble Oil & Refining Co., Encino, Tex.

MCDILL, WILLIAM HOWARD (Age 36) Asst. Prof. of Eng., Texas Coll. of Mines & Metallurgy, El Paso, Tex.

(*Continued on page 90*)

McNeil, Earl Kingsley (Age 35) Chf. of Drainage Survey and Supervisor of L line parties, U.S. PRA, Cochabamba, Bolivia.

Michel, John Field (Age 30) National Guard Instructor, Engr. Combat Bn., U.S. Army, Grand Forks, N.Dak.

Minkus, Alexander John (Age 36) Senior Asst. Engr., Water Bureau, Metropolitan Dist., Hartford, Conn.

Mintzer, Olin Wesley, III (Jun.) (Age 31) Instructor in Surveying, Purdue Univ., West Lafayette, Ind.

Morcone, Donato Amalio (Age 31) Civ. Engr., Godwin Constr. Co., New York City.

Moy, Harland Frederick (Jun.) (Age 32) Engr. Inspector, Spokane, Portland & Seattle Ry., Portland, Ore.

Murray, Raymond Arthur (Age 33) Post Engr., U.S. Army, Linden, N.J.

Neil, Patric Wilson (Jun.) (Age 34) Dist. Engr., SCS, Plainview, Tex.

Nouel C., Bernardo Augusto (Age 32) Inspector Principal, de las Obras de Ensanche del Pto. de La Guira, on construction for Frederick Snare Corp., Caracas, Venezuela.

Okum, Daniel Alexander (Jun.) (Age 30) Teaching Fellow in San. Eng., Graduate School of Eng., Harvard Univ., Cambridge, Mass.

Ray, Claude Harlan (Jun.) (Age 34) City Engr., Hawthorne, Calif.

Reid, George Willard (Age 30) Associate Prof. of Civ. Eng., Georgia School of Technology, Atlanta, Ga.

Rice, William Thomas (Jun.) (Age 35) Supt., Potomac Yard, Richmond, Fredericksburg & Potomac R.R., Alexandria, Va.

Ruvkun, Sam (Jun.) (Age 28) Civ. Engr., Plant Eng. Dept., Kaiser Frazer Corp., Willow Run, Mich.

Shain, Clarence Blackburn (Age 51) Director of Highways, State of Washington, Olympia, Wash.

Sherman, George Bliss (Age 38) Asst. Physical Testing Engr., California Div. of Highways, Sacramento, Calif.

Smith, Adrian Woodrow (Jun.) (Age 35) Engr., Hq., 6th Army, War Dept., Presidio of San Francisco, Calif.

Storms, Richard Edward (Jun.) (Age 35) Contr.'s Engr., Walters & Prater, Inc., Norristown, Penn.

Turansky, Walter (Jun.) (Age 28) Office Engr., The Associated Constr. Co., Hartford, Conn.

Turpin, William Burdges (Age 30) Civ. Engr., U.S. Army, Caribbean Quarry Hts., Canal Zone: also private practice, Curundu, C.Z.

Weaver, Gerald Gregory (Jun.) (Age 34) Draftsman and Stress Analyst, E. I. du Pont de Nemours & Co., Wilmington, Del.

Zeman, Joseph Michael (Jun.) (Age 34) Cartographer, Div. of Air Navigation, Hydrographic Office, Washington, D.C.

APPLYING FOR JUNIOR

Ahmad, Mohammad Anis (Age 20) Graduate student, Univ. of Tennessee, Knoxville, Tenn.

Anderson, Donald Arthur (Age 22) Planning Technician with I. S. Shattuck, Planning and Traffic Consultant, Wayzata, Minn.

Bremser, Lawrence William (Age 30) Designer, Black & Veatch, Kansas City, Mo.

Choudhury, Amarendra Nath Dutta (Age 27) With Corps of Engrs., U.S. Army special training in river training works, Waterways Experiment Station, Vicksburg, Miss.

Christ, Roy Henry (Age 30) Engr., Vibration Measurement Engrs., Chicago, Ill., and New York City.

Dagdelen, Oguz (Age 21) Student in Civ. Eng., Graduate School, Univ. of Illinois, Champaign, Ill.

Flor, Loy Lorenz (Age 28) San. and Cathodic Engr., Spring Valley and Lemon Grove Irrigation Dist., El Cajon, Calif.

Gonzalez Hurtado, Hernando (Age 30) Sales Mgr., Peter Snatamaria & Co., Almacen Universal, Cali, Columbia.

Herrin, William Henry (Age 26) Structural Engr., Burns & McDonnell Eng. Co., Kansas City, Mo.

Truque Gurdian, Luis Alberto (Age 24) BSCE, Univ. of Costa Rica; at present graduate student, Univ. of Illinois, Urbana, Ill.

Warnick, Calvin Cropper (Age 27) Asst. Prof. of Civ. Eng. and Research Technologist, Dept. of Civ. Eng., Univ. of Idaho, Moscow, Idaho.

UNIV. OF CONN.

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Good, Edward Samuel, Jr., 1947 (25)

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Savage, William Thomas, Jr., 1947 (23)
Simon, Norman Walter, 1947 (23)
Smith, Donald Everett, 1947 (25)
Tann, Richard Albert, 1947 (22)

GA. SCHOOL TECH.

Biddinger, Charles Jr., 1947 (25)
Gibbons, Ashby Trice Jr., 1947 (22)
Matthews, Jamie Franklin, Jr., 1947 (24)
Mitchell, Frank, 1947 (23)

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Dreelin, Andrew Michael, III, 1947

WASH. STATE COLL.

Jizba, Jaroslav Zdenek, 1947

UNIV. OF WYO.

Longenecker, William Henry, 1947

The Board of Direction will consider the applications in this list not less than thirty days after the date of issue.

CHANGES IN MEMBERSHIP GRADES

ADDITIONS, TRANSFERS, REINSTATEMENTS, AND RESIGNATIONS

(From December 10, 1947, to January 9, 1948)

Additions to Membership

Ager, John Walter Albert (Assoc. M. '47) Design Engr., Richard Costain Ltd., Dolphin Square (Res., 32 Harcourt Terrace), London S.W., England.

Aisawa, Shiro (Jun. '47) Special Research Asst., Univ. of Illinois, 207 Talbot Laboratory, Urbana, Ill.

Alspach, John Robert (Jun. '47) Plant Engr., Delos M. Palmer, Cons. Engr., 739 Nicholas Bldg. (Res., 2538 Aldringham Rd.), Toledo 6, Ohio.

Andrews, John Avery (Jun. '47) Geodetic Engr., Inter-American Geodetics Survey, Box 2031, Balboa Heights, C.Z.

Anthony, George (Assoc. M. '47) Associate Hydr. Engr., Geological Survey, Water Resources, 702 Appraiser's Bldg., San Francisco, Calif.

Autrey, William Stanley (Jun. '47) Roadway Asst., Atchison, Topeka & Santa Fe Ry., Care, J. R. Rushmer, Santa Fe Bldg., Amarillo, Tex.

Baker, Darrell Francis (Jun. '47) Graduate Student, Illinois Inst. of Tech., 3300 Federal St., Chicago 16, Ill. (Res., 1617 West Jefferson St., Boise, Idaho.)

Balasubrahmanyam, Sundaresan (Jun. '47) Supervisor, Madras Public Works Dept., Government of Madras, Madras, India; Care, U.S. Bureau of Reclamation, Federal Center, Denver, Colo.

Banks, Arthur Kelly (Jun. '47) (Banks Eng. Co.), 430 East Washington St., Charleston, W.Va.

Barentine, Elbert Hamilton (Assoc. M. '47) Surveyor, Crosby Chemical Co. (Res., P.O. Box 51), DeRidder, La.

Barnard, Edward Martin (Assoc. M. '47) Chartered Civ. Engr., "Oaklands," Wargrave Road, Twyford, Berkshire, England.

Barnes, John Patrick (Assoc. M. '47) Constr. Engr.,Senior & Palmer, Inc., 50 Church St., New York (Res., 40-20 Two Hundred twenty-first St., Bayside), N.Y.

Barnes, Merrill Eldon (Jun. '47) Instrumentman, Idaho Power Co., 13th and Bannock Sts. (Res., Route 1), Boise, Idaho.

Barrett Cecil Hewins (M. '47) Asst. Chf. Engr., Dept. of Public Works, City of Pittsburgh, 417 City County Bldg., Pittsburgh, Pa.

Baxter, Dhunjibhoy Cursetjee (M. '47) Project Officer (Govt. of India), Central Technical Power Board, "Cleremont" (Res., Care, Lloyds Bank Ltd.), Simla, India.

Beckman, Wallace Jennings (Jun. '47) Junior San. Engr., Gannett Fleming Corddry & Carpenter, 600 North 2d St., Harrisburg, Pa. (Res., 1930 Sixty-fourth St., Brooklyn 4, N.Y.)

Begley, Thomas Reid (Jun. '47) Engrs. Asst. Francis Eng. Co., Eddy Bldg. (Res., 325 Carroll St.), Saginaw, Mich.

Behrens Paul Dudley (Jun. '47) Junior Engr. Magnolia Petroleum Co., Eng. Dept., Magnolia Refinery, Beaumont (Res., 5121 Lovell, Fort Worth 7), Tex.

Bell, William Hayes, Jr. (Assoc. M. '47) Archts. Supt., Albert Kahn Assoc. Archts. & Engrs. Inc., P.O. Box L, Robertson (Res., 2464 Hartford Ave., St. Louis), Mo.

Benjamin, Irwin Arthur (Jun. '47) Inst., Civ. Eng., Kansas State College, Manhattan, Kans.

Berman, Manuel (Jun. '47) Constr. Foreman, Balsam Constr. Co., State Rd. & Penarth Ave.,

(*Continued on page 92*)

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The Treasury Department acknowledges with appreciation the publication of this message by

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Upper Darby (Res., 3415 Spring Garden St., Philadelphia 4), Pa.

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BETHELL, WILLIAM DECATUR (Jun. '47) Junior Civ. Eng., Calif. Div. of Highways, Marysville (Res., Penryn), Calif.

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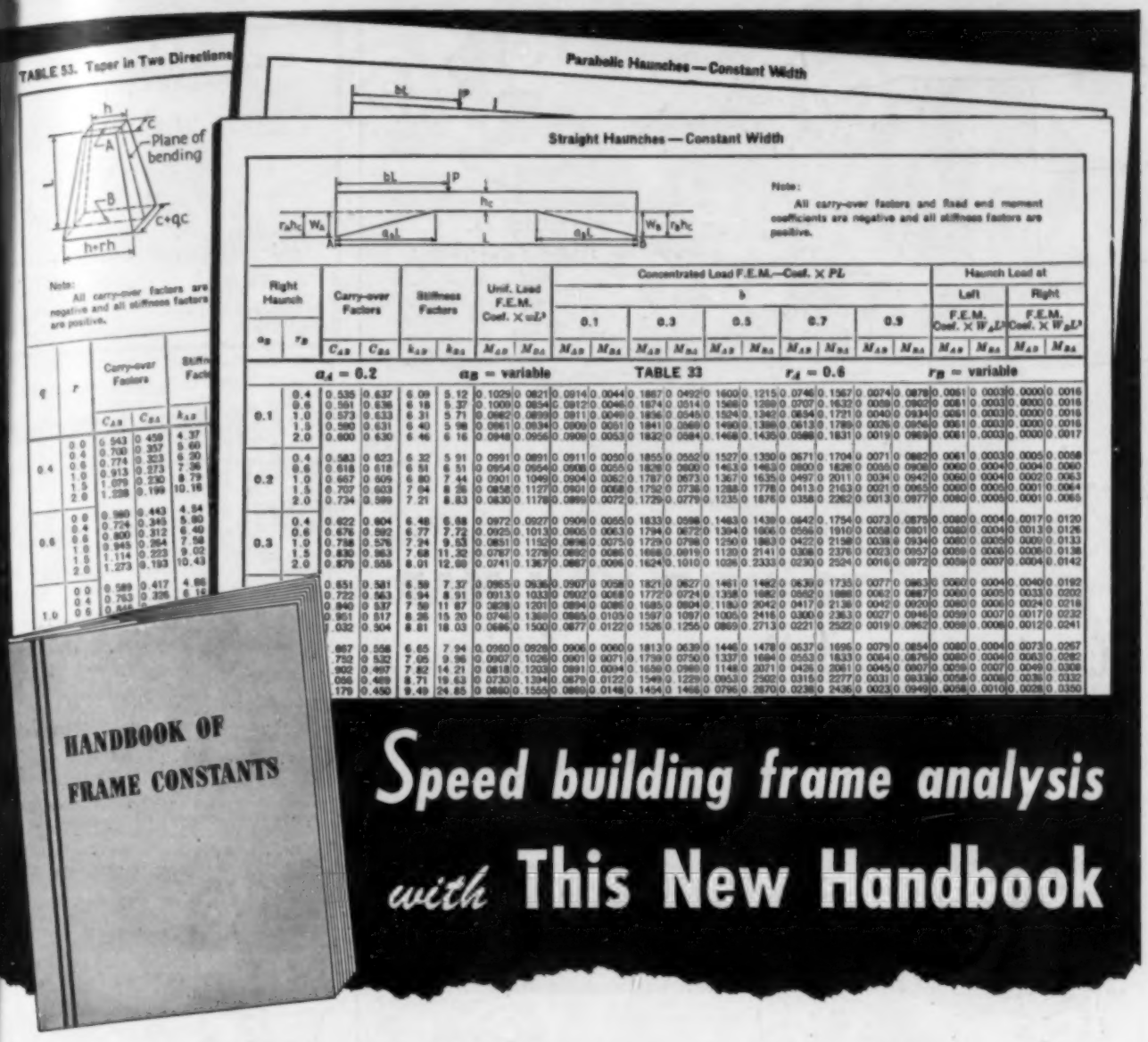

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(January 9, 1947	21,318)

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GARDNER, THOMAS HERBERT, M., 506 Maupas Ave., Savannah, Ga., reinstated Dec. 18, 1947.

HOLT, TAYLOR, JR., Assoc. M., Mgr., Western Office Technical Staff, The Coca-Cola Bottling Co. of Ohio, Care, The Coca-Cola Bottling Co. of California, 1340 Cypress St., Oakland, Calif., reinstated Dec. 4, 1947.

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LESHER, CARL EUGENE, JR., Assoc. M., San. Engr., H. K. Ferguson Co., Ferguson Bldg. (Res., 21533 North Park Dr.), Cleveland 16, Ohio, readmitted Nov. 17, 1947.

MILAN, ANTHONY GEORGE, Assoc. M., Care, J. S. Milan, 4645 Rokeby Rd., Baltimore 29, Md., reinstated Dec. 31, 1947.

MONARCHI, JOSEPH L., Jun., 2651 South Grant St., Denver 10, Colo., reinstated Dec. 22, 1947.

O'REILLY, THOMAS CHARLES, Assoc. M., Asst. Civ. Engr., Long Beach Water Dept., 215 West Broad-

...RAY (Res., 1056 Walnut Ave.), Long Beach 13, Calif., readmitted Nov. 17, 1947.

...BERTI, LOUIS, Assoc. M., Civ. Eng. Draftsman, Dept. of City Planning, Room 2530, Municipal Bldg., New York, N.Y., readmitted Nov. 17, 1947.

...NER, WILLIAM SHERMAN, M., Asst. City Engr., City of Modesto, 715½ Tenth St., Modesto, Calif., readmitted Nov. 17, 1947.

Resignations

...TON, JAMES WILLIAM, Jun., Vice-Pres., Republic National Bank of Dallas, Dallas, Tex., resigned Dec. 31, 1947.

...DINGTON, NORMAN, Assoc. M., Col., Supreme Commander's H.Q., E-in-C's Branch, G.H.Q., Kashmir House, New Delhi, India, resigned Dec. 31, 1947.

...OWNING, GLEN EARL, Jun., P.O. Box 1864, College Station, Tex., resigned Dec. 31, 1947.

...TLER, WILLIAM LAWRENCE, M., 123 South Broad St., Philadelphia 9, Pa., resigned Dec. 24, 1947.

...NINGTON, CHARLES SIMPSON, Assoc. M., 490 Murray St., Pelham 65, N. Y., resigned Dec. 31, 1947.

...NBADI, HARRY, M., 17 Redcourt Ave., Armadale S.E. 3, Melbourne, Australia, resigned Dec. 31, 1947.

...REY, JOHN FREDERICK, Jun., 60 Prospect St., Newark, Ohio, resigned Dec. 30, 1947.

...OWNER, JAY., M., 75 Larchmont Ave., Larchmont, N.Y., resigned Jan. 5, 1948.

...SHER, FLOYD SETH, JR., Jun., 407 Continental Oil Bldg., Denver 2, Colo., resigned Dec. 30, 1947.

...ANEY, JOHN FRANCIS, JR., Jun., 31 Chase Ave., Lexington, Mass., resigned Dec. 31, 1947.

...SELING, DOROTHY CROUCH (MRS.), Jun., Care, Boyle Const. Co., Sumter, S.C., resigned Jan. 5, 1948.

...RBER, HENRY JOHN, Assoc. M., 16000 Nelacrest, Cleveland 12, Ohio, resigned Dec. 31, 1947.

...URFELD, SAMUEL, Jun., 41-15 Forty-fourth St., Long Island City 4, N.Y., resigned Dec. 30, 1947.

...NDS, WALTER, Assoc. M., City Assessor, City Hall, Ann Arbor, Mich., resigned Dec. 31, 1947.

...cGAUGHEY, PAUL THOMAS, Jun., 144 Mayland St., Philadelphia 44, Pa., resigned Dec. 31, 1947.

...LLER, CHARLES WALTER, Assoc. M., 2706 North Calvert St., Baltimore 18, Md., resigned Dec. 31, 1947.

...NICONE, LORENZ MAURICE, Jun., 107 North Grove St., Valley Stream, N.Y., resigned Dec. 30, 1947.

...TOLANI, LAWRENCE, Assoc. M., Care, State Highway Dept., Road Design Development, Austin, Tex., resigned Dec. 31, 1947.

...PANEK, MAXWELL CHARLES, Jun., East Chateau Apts., Woodmere, N.Y., resigned Dec. 30, 1947.

...TTERSON, THOMAS SHAFFER, Assoc. M., 609 West Fairmount Ave., State College, Pa., resigned Jan. 5, 1948.

...UENTIN, WILLIAM JOHN, Assoc. M., 2123 Eye St., N.W., Washington, D.C., resigned Dec. 31, 1947.

...CE, CLAUDE HAYES, Assoc. M., R.F.D. 2, Dover, N.H., resigned Dec. 31, 1947.

...UCKERT, WILLIAM CARL, Jun., 351 Edgewater Apt., Essex, Baltimore 21, Md., resigned Dec. 24, 1947.

...UHLING, GEORGE HUTZE, Assoc. M., 317 Marshall, East Lansing, Mich., resigned Dec. 31, 1947.

...NDS, ROBERT LAWRENCE, M., 28 Orchid St., Floral Park, N.Y., resigned Dec. 30, 1947.

...HNEIDER, EDWIN WALLACE, Affiliate, 110 West Virgilia St., Chevy Case, Md., resigned Dec. 30, 1947.

...HOBINGER, CHARLES WEBSTER, Jun., 558 East Gates St., Philadelphia 28, Pa., resigned Dec. 31, 1947.

...TORY, JESSE WILLIS, Jun., Mountain Home, Ark., resigned Dec. 30, 1947.

...LLARICO, ALBI KIMBALL, Jun., 1917 Market St., Harrisburg, Pa., resigned Dec. 24, 1947.

...YLOR, OLIVER GUY, M., 6313 Georgia St., Chevy Chase, Md., resigned Dec. 24, 1947.

...OMAS, CHARLES MITCHELL, M., 100 Kimball Lane, Oak Ridge, Tenn., resigned Dec. 30, 1947.

...WING, WILLIAM HAROLD, Jun., 156 Fifth Ave., New York 10, N.Y., resigned Dec. 31, 1947.

...CHER, FRANK LAURAIN, Jun., 244-52 Ninetieth Ave., Bellerose, N.Y., resigned Jan. 5, 1948.

...CHTER, RICHARD EMIL, Assoc. M., 1200 Missouri Pacific Bldg., St. Louis 3, Mo., resigned Dec. 31, 1947.

...TTLES, HENRY STARR, III, Jun., 147 West Lanvale St., Baltimore 17, Md., resigned Dec. 31, 1947.

...EATLEY, JOHN PAUL, Jun., Flight Test, NAS Patuxent River, Md., resigned Dec. 31, 1947.

...LLETT, ALBERT BERTRAM, Assoc. M., Sacramento, Calif., resigned Dec. 31, 1947.

...THERELL, PAUL WALKER, Jun., 3 Bradford St., Taunton, Mass., resigned Dec. 31, 1947.

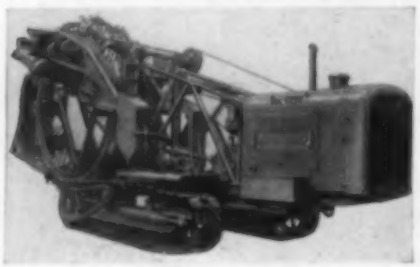
...LF, CLEMENS WILLIAM HENRY, M., 3915 East Ashman, Route 1, Midland, Mich., resigned Dec. 31, 1947.

EQUIPMENT, MATERIALS *and Methods*

NEW DEVELOPMENTS OF INTEREST, AS REPORTED BY MANUFACTURERS

Ditcher

THE BUCKEYE ditcher which succeeds the Model 12 has just been placed on the market. This new ditcher, Model 312, has been subjected to field tests in actual service by contractors in various parts of the country. Compared with its predecessor, this new model is said to offer greater range, simplified controls, and better balance. It is built for longer service, faster digging, and reduced operating and maintenance costs. It cuts ditches 16 in. to 30 in. wide and up to 6 ft deep. The digging wheel is supported by a rugged frame made out of tubular members. The ditcher is several inches shorter than the old model and approximately 500 lb



lighter. A fluid coupling in conjunction with a friction clutch permits loads to be picked up or relieved with either or both. Its diesel engine develops 67 hp at 1,600 rpm. Digging speeds up to 57.5 ft per min are provided. The ditcher has four forward and four reverse road speeds. **Gar Wood Industries, Inc., Findlay Division, Findlay, Ohio.**

"Swing-Around" Loader

A NEW INVENTION designed to reduce excessive tractor costs in the heavy construction equipment field has been announced. By eliminating over fifty per cent of movement of crawler tractors, maintenance time and fuel costs are said to be cut in half with the use of the new Decker "Swing-Around" Loader. The Decker loader is designed to handle mass production loading and can be used as a shovel, bulldozer, grader, and ditcher. The bucket swings 180 deg on a circular track to permit loading one truck while a second truck is taking position on the opposite side. A complicated mechanism is not required, for power is obtained from the crawler tractor engine and applied through a simple hydraulic system. Controls are positive-acting and located within easy reach of the operator. Three complete operation cycles can be made every minute. This loader will be produced to fit several of the most popular models of crawler tractors, ranging from 1 to $2^1/_2$ cu yd buckets in size. **Decker Bros., Inc., 331 U.S. National Bank Bldg., Denver 2, Col.**

1948 Trucks

A NEW LINE of Ford trucks is being shown to the public. The streamlined 1948 trucks are said to be notable for an unprecedented range of models and capacities as well as many engineering changes. Two new series—F-7 and F-8—have maximum gross vehicle weights of 19,000 and 21,500 lb, respectively. Another new series is the six-cylinder cab-over-engine model. Three new power plants are available—a 95-hp six-cylinder engine, a 100-hp V-8, and a 145-hp V-8. Radiator grille and headlights are recessed in a functional pattern. Greater front end strength has been achieved through improved sheet-metal suspension and heavier construction. Advanced cab design provides more space and better ventilation. **Ford Motor Company, Dearborn, Mich.**

Lugger Crane

THE LUGGER CRANE is a highly versatile and mobile hydraulic unit which is said to provide exceptional utility at low cost. It lifts and carries up to 6,000 lb. Ten feet of vertical boom travel is provided with a corresponding cable travel of 16 ft. Maximum clearance under hook is 18 ft, 6 in. Sidewise movement of the boom is limited to assure stability when handling maximum loads, even with unskilled operation.

All movements of the crane are controlled by one man from the driver's seat through a simple system of precision Daybrook hydraulics. The half-track chassis works on almost any kind of terrain from factory floor to rutted mud, and operates at speeds of up to 40 mph. In addition to lifting and carrying, the chassis is also equipped to perform a variety of towing and pushing operations. Actual usage of the Lugger Crane at present ranges from oil fields and general construction projects to factories and warehouses. **Day-Smith Hydraulic Crane Corp., Camp Hill, Pa.**

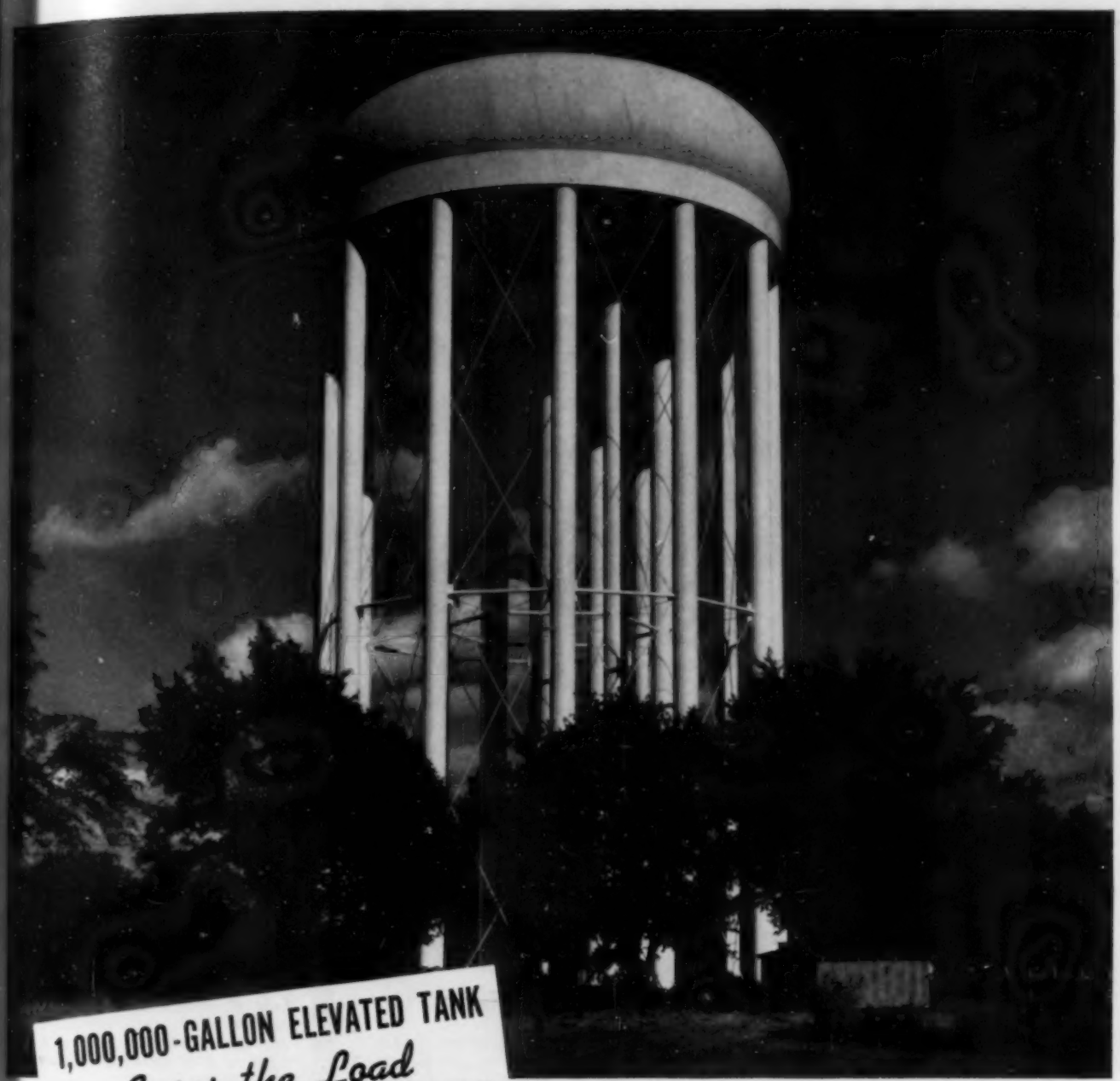
Finishing Machine

A DIAGONAL SCREED finishing machine is being offered after eighteen months of test use on highway work. It is equipped with a transverse front screed and a pivoted rear screed which the operator can swing diagonally in either direction to operate at whatever angle best suits the work. When finishing super-elevated curves and any slab with a drainage pitch, the angle of the rear screed causes it to carry the desired amount of material uphill and compact it solidly against the higher form. This function is said to eliminate most or all of the need for carry-back. Gradual adjustments of the screed angle are made without stopping as the machine approaches and leaves super-elevated curves.

An important gain is in the accuracy of surface resulting from the fact that the rear screed, operating diagonally to the front screed, always meets the material at a different point, removing high spots with a slicing action and troweling material into low spots. Diagonal screeding is credited with the ability to finish harsh mixes faster without tearing because of the fact that the rear screed works at an angle against the material left by the front screen. Both screeds have a wide range of speeds and are of the quick-crown-change type. **The Jaeger Machine Co., Columbus 16, Ohio.**

Straight Line Cutter

A LONG BEACH firm has designed a portable straight cutter which holds a welding torch and feeds it along a straight line. By turning a simple geared crank at the end, the torch travels along a predetermined line and cuts through the metal as true as if lathe-cut. Known as the C & H Straight Line Cutter, the device will hold any torch. It has an adjustable holder so the torch can be angled to cut bevel or scarf. It has a positive feed so that the operator can direct the torch as slowly or as rapidly as desired. A stainless steel wheel rolling along the work keeps the torch at a uniform distance from the work. **J. A. Campbell Co., 645 East Wardlow Road, Long Beach 7, Cal.**



1,000,000-GALLON ELEVATED TANK *Eases the Load* ON A MUNICIPAL POWER PLANT

One of the benefits that Columbia, Mo., obtains through the use of the Horton elevated tank shown above is a reduction in pumping costs. The tank has sufficient capacity so that the high service pumps may be shut down during a 3 to 4 hour period in the evening when the peak electric load is on the municipal power plant, thus reducing the peak demand on the boilers. The tank is re-filled during off-peak periods at a much lower pumping cost.

In addition to reducing pumping costs, this elevated tank, together with the two new fire stations and larger mains in several areas, is expected to lower the insurance premiums an estimated $60,000 to $75,000 per year for the residents of Columbia.

The water for Columbia's distribution system comes from three deep wells ranging from 1200 ft. to 1500 ft. in depth. It is pumped into underground reservoirs having a capacity of $4\frac{1}{2}$ million gallons and re-pumped from these reservoirs into the distribution system by steam driven service pumps.

On your next job that requires water storage facilities, write our nearest office for estimating figures on HORTON elevated tanks.

ATLANTA • BIRMINGHAM • CHICAGO • CLEVELAND • DETROIT • HOUSTON • LOS ANGELES • NEW YORK • PHILADELPHIA • SAN FRANCISCO • TULSA

Chicago Bridge & Iron Company

DESIGN • FABRICATION • ERECTION

PLANTS IN BIRMINGHAM, CHICAGO AND GREENVILLE, PA. • IN CANADA: HORTON STEEL WORKS, LIMITED, FORT ERIE, ONTARIO

Heavy-Duty Bulldozers

THREE NEW TYPE heavy-duty bulldozers, especially designed for Case industrial wheel tractors, are now being manufactured. These bulldozers cut the full width of the tractor. Bowl design is the same rigid, internally ribbed, welded box as used in ATEO dozer for big track-type tractors. Bulldozer is securely fastened to tractor at the transmission case, drawbar pad, and rear axle housing. Bowl and push members are built to take full drawbar power of the Cast tractor in the roughest kind of work. Bulldozer push members are pivoted above the rear axle so

part of the working is transferred to the rear wheels to increase traction. Push members do not interfere with steering. Front wheels will turn in normal tractor radius even when blade is in dozing position and below ground level. Blade is powered both up and down by front-mounted hydraulic pump. These bulldozers are especially recommended for backfilling, clean-up work, fast bulldozing, excavating around foundations, light stripping, aggregate handling and leveling. **American Tractor Equipment Corp., 9131 San Leandro Blvd., Oakland 3, Cal.**

Concrete Filler

AIRPORTS ARE now being mended with rubber and paper. The paper used is one of the Kraftcords. The James Gibbons Co., Relay, Md., and the E. W. Twitchell Co. of Philadelphia pooled their knowledge and technical skills in airport work. The Gibbons Co. had a contract to seal inch to inch and a half joints between the concrete squares on an airport's runways. For years, asphalt had been used as a filler with only limited success. It was forced out of the joint and became brittle during expansion and contraction of the concrete. A hot rubber sealing compound was specified for the job but ordinary heating methods ruined the rubber. A new method solved that problem but there was still the problem of finding the best filler to dam up the bottom of the crack until the rubber solidified. The search for that filler led to the use of Kraftcord. The joints were cleaned with the aid of a plowlike device on a tractor. A rotary brush suspended underneath the tractor brushed them clean. To force the three-eights to half-inch paper-cord packing into the joints, Gibbons engineers developed a special, four-wheeled, hand-operated machine. Central point of the

chine is a reel on which the paper cord wound. Feeding over a pulley arrangent, the cord is strung along the joint ening and forced downward by a comssing disk that packs it tightly. Since s rubber-paper combination is conered to be the ideal solution to the port runway problem, it is logical to lieve that this method can be used with great success on the highways. **E. W. itchell, Inc., Philadelphia, Pa.**

Hopper-Car

TWO NEW UNITS for facilitating the unding of stone, sand, gravel, and all bulk aterials from hopper cars are announced. hese units consist of: a new type heavyty car unloader called the "358" which s a capacity range of up to three tons r minute operating in pits or above rails, d for working with the 358 is the new 363 ockpiler-loader which features many new velopments. Unique among the many atures of the 358 unloader is its chain and lt conveyor. Chain and belt are riveted gether by means of steel attachments d cleats. Power is transmitted through ain and belt to give positive belt movent at all times. The 363 stockpilerader is completely new in design. It has tair-channel frame and simple swiveling heels make it flexible. Available with ain or cleated belts, the 363 eliminates ouble due to old-fashioned chain and rocket drive through its use of V-belt rive, two precision gear reducers, and a haft drive to the head pulley. Threenit belt carriers mounted on welded steel ases through the belt and minimize belt ear. Anti-friction bearings are used roughout. It is available in a belt width f 24 in. and in lengths of 25, 30, and 35 ft. **arber-Greene Company, Aurora, Ill.**

Threadless Malleable Fittings

FLAGG-FLOW threadless malleable pipe ttings have just been introduced to indusry. The revolutionary threadless fitting s said to simplify any piping layout and nake it possible to join steel or wrought ron pipe without threads and without elding by a brazing method any cometent pipe fitter can use. Described as he first joint ever produced that opens the ay to reducing the wall thickness and eight of pipe, Flagg-Flow enables the use f plain end pipe. It also affords 30 per ent less weight than the same kind and ize of threaded fitting. Designed for razing to standard black steel or wrought ron pipe, the new fittings are currently nade in sizes up to and including 2 in. Flagg-Flow fittings are said to prove the bility of the joint to withstand much igher rates of vibration than threaded oints. The threadless malleable fittings re also of great value in confined spaces here it is difficult, or even impossible, to se a pipe wrench, in locations inaccessible or maintenance after installation, and in hin walls and partitions where ordinary, ulky fittings would be exposed, and in oncrete, or cinder-fill flooring. **Stanley G. Flagg & Company, Inc., Philadelphia, Pa.**

Pick-up Unit

A UNIQUE COMBINATION of a Stearns road sweeping magnet and a Dempster-Dumpster body receptacle for receiving the accumulated scrap metal picked up by the magnet has been evolved by Dempster Bros., engineers. The rig consists of a Stearns 18 in. × 96 in. magnet used with a standard Dempster-Dumpster hoisting unit. The road sweeping magnet is detachable by removing two pins and the chains from body. The proper height from the ground for using the magnet is adjusted by raising or lowering the boom of the unit. Electrical energy for the magnet is obtained from a gasoline-motored generator mounted on the side of the chassis, and the current is controlled by a switch located at any convenient place for the operator. **Stearns Magnetic, Milwaukee 4, Wis.**

300-Ampere Generator

DELIVERIES OF A 300-amp bare welding generator are now being made by P & H. This unit has a welding service range of from 30 to 375 amp. Called the model WC-300, it is designed for easy coupling to a gasoline engine or power take-off. A V-belt pulley arrangement makes exact alignment between power and generator unnecessary, thereby simplifying the building of the welder. This model has just one control for any desired welding heat within the machine's entire range. P & H's "Visa-matic" calibration plate permits selection of the correct welding current for all classes of electrodes. **Harnischfeger Corp., Welding Division, 4400 W. National Ave., Milwaukee 14, Wis.**

Plastic Sealant

A NEW MORTAR sealant has been specially formulated for use on glass block. Known as Klee Sealant, it coats the exterior mortar joints, adheres to the mortar, and forms a tight flexible bond to the glass, expanding and contracting with the mortar as well as the glass. It is of plastic-like consistency, can be applied with a caulking gun or thinned down to brushing consistency, and can be indented with a finger nail, similar to rubber. **Research Laboratory, The American Fluresit Co., 635 Rockdale Ave., Cincinnati, Ohio.**

Literature Available

VALVE CATALOG DEBUT—A 60-page hard cover volume providing detailed description and specifications of rubber seat butterfly valves and their accessories is now available. The book, designed for engineers, emphasizes actual blueprint reproductions for reference to work in progress. The valves themselves are unique in their design and flexibility of operation. A rubber seat engages the rotating butterfly disk to provide a tight seal in low-pressure fluid service. Features included in the catalog are design of the valves, flexibility of operations, sizes, materials to suit service conditions, remote operation methods, and many others. **Henry Pratt Company, 2222 South Halsted St., Chicago 8, Ill.**

ASPHALT PLANK—A 5-page folder describing asphalt plank is now being offered. Included in the folder is an article entitled "Helicopter Landings Expand Roofing Opportunities" which tells of the use of asphalt planks as the material for roofs used for helicopter landings. Methods of laying, specifications, waterproofing qualities, and methods of application are also discussed and pictured. **Servicised Products Corp., 6051 65th St., Chicago 38, Ill.**

HYDROPLEX PUMP—Bulletin No. 47-8020 describes the Hydroplex pump, a split case multi-stage centrifugal pump for low-capacity and high-pressure pumping. The eight pages in two colors cover various views of the Hydroplex, cross-section schematic, subassemblies, parts and dimensional orthographic drawings, and also installation photographs. The Hydroplex, as described in the bulletin, is equipped with a direct-connected electric motor and its head range is 450 to 1,700 ft, and its operating speed 3,550 rpm at 60 cycles and 2,950 at 50 cycles. **Byron Jackson Co., Pump Division, Los Angeles 54, Cal.**

BATCHING PLANTS—Advantages and condensed specifications of Noble batching plants are described in four illustrated 4-page folders. A separate folder is devoted to each of four plant sizes: 80, 100, 150, and 350 tons. Plan drawings and photographs of field installations are included for each model. Special features explained include the principle of weigh batching with central cement compartment, one-man operation, portability, and flexibility of setup. **Noble Co., 1860 7th St., Oakland 7, Cal.**

NAILER JOISTS—As a simplification measure, effective June 1, 1948, the manufacture of six types of Nailer Joists—namely, Types 80W, 100W, 120W, 121W, 141W, and 161W—will be discontinued. Thereafter, all members identified with the Steel Joist Institute will manufacture only fourteen sizes of Standard Joists and fourteen sizes of Nailer Joists. A new table which supersedes the current issue of the handbook gives steel joist designation, depth resisting moment, and maximum end reaction of each of the types of joists to be manufactured. **Steel Joist Institute, 1200 Eighteenth St., N.W., Washington 6, D.C.**